

Metal Finishing

POLISHING AND BUFFING • BARREL FINISHING • CLEANING
PLATING • ANODIZING • RUST PROOFING • LACQUERING & ENAMELING

OCTOBER, 1958

CONTENTS:

Applications for Alkaline Descaling Cleaners

Use of Alkaline Derusters

The Sulphur Dioxide Test

Accelerated Corrosion Testing

Science for the Coatings Technologist

*Paint Additives: Driers and Anti-Skinning
Agents*

New Painting Facilities Effect Production Economies

Finishing Operations at a Modern Plant

Pores and Pitting of Plated Deposits

Causes and Cures

Electropolishing

Less Commonly Electropolished Metals

Electrochemical Society Meets in Ottawa

Abstracts of Papers Presented

Finishing Pointers

The Use of a Coulometer

Phosphating Treatments

A Comprehensive Patent Literature Survey

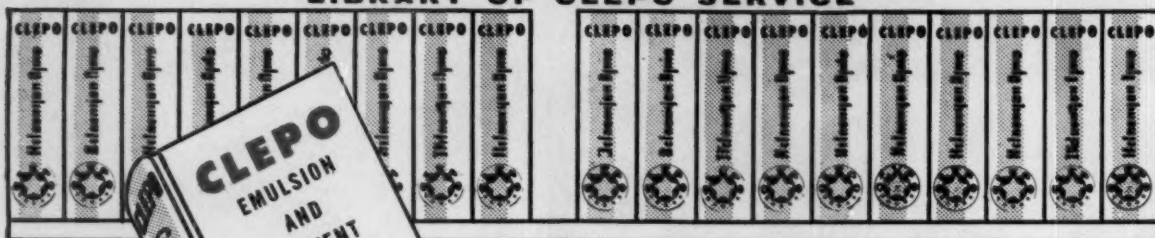
Science for Electroplaters

Amino Acids

Complete Contents Page 43

Read and pass on—

LIBRARY OF CLEPO SERVICE



CLEPO 8-S

Consider these four different applications for which, among other uses, CLEPO 8-S long ago proved its effectiveness and economy in action.

- ★ removing drawing compounds from extruded aluminum parts.
- ★ cleaning in spray-type or tumble-type washing machines.
- ★ cleaning large pieces too heavy to handle or to immerse in a tank; it's applied directly to the surface with brush or swab and then hosed off.
- ★ cleaning paint brushes.

A VERSATILE EMULSION CLEANER

These are suggestions as to how CLEPO 8-S can help keep both work and equipment clean of grease, oils, polishing compounds, dirt and smut. There are other uses for CLEPO 8-S and there are other CLEPO Solvents and Solvent-Emulsion Cleaners to do other work.

Cleaners make up an important phase of CLEPO Service. If you are having cleaning trouble—either in effectiveness of work or costs—ask the CLEPO Field Man to go over the long list of CLEPO Cleaners and see if one of them won't take care of your problem better.

For more than twenty-five years the CLEPO Technical Staff has devoted its attention to cleaning, stripping, tumbling and other problems encountered daily in the metal finishing field. This service is at your disposal.

FREDERICK

GUMM

Chemical Company Inc.

538 FOREST STREET, KEARNY, N. J.

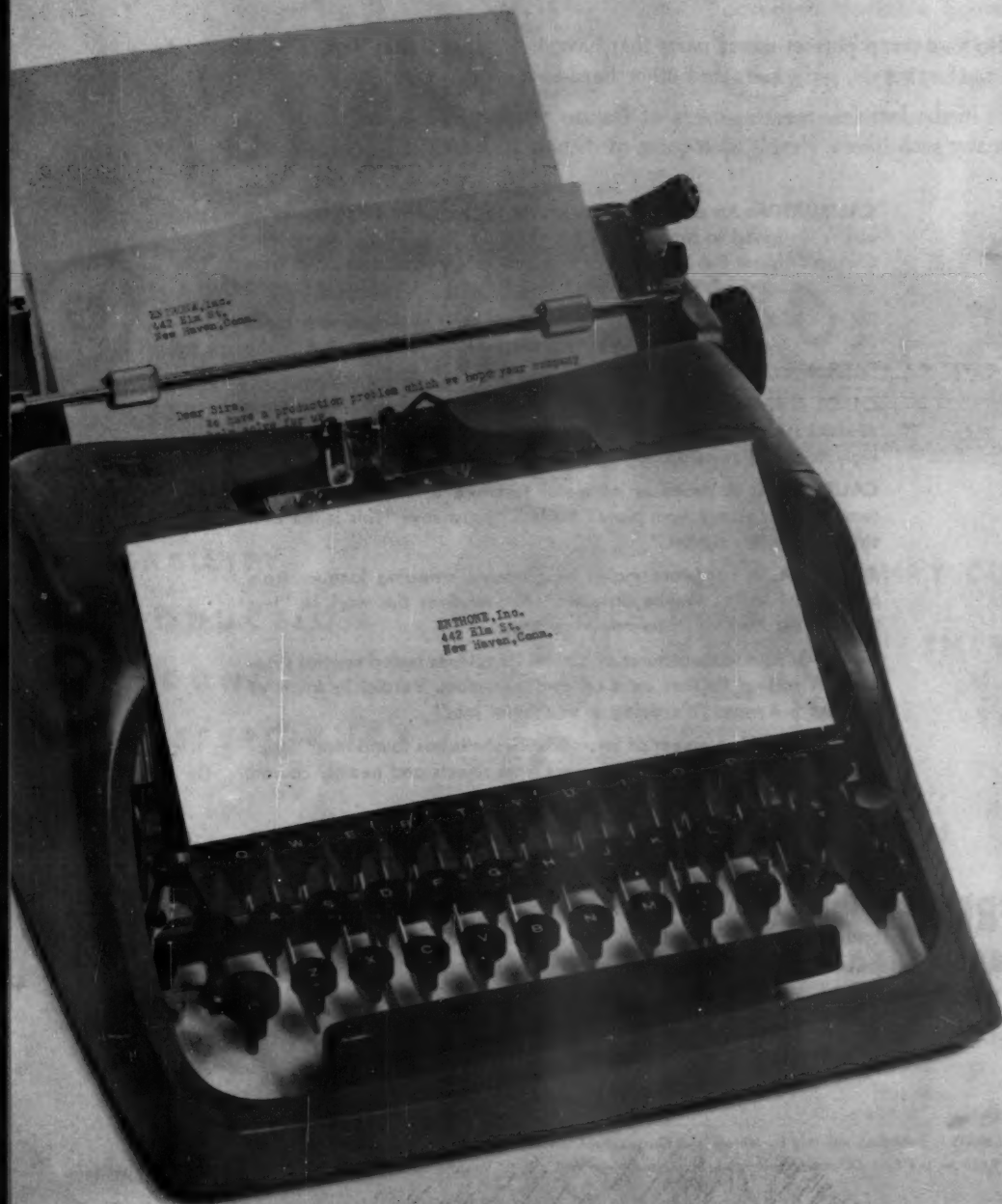
How to make metal blackening an exact science: What metal do you have to blacken?

Steel, copper, brass, zinc? There are seven Ebonol® compounds in Enthone's specially developed series of blackeners for you to call on for jet blackness, maximum wear resistance and adhesion.

Enthone is exceptionally well equipped and qualified to assist you in all phases of metal finishing.

Years of practical experience, extensive research and service laboratory facilities manned by a team of specialists in the finishing field are at your service. Write us about your needs or problems. Send

a sample of your product in question, if possible. Enthone, Inc., 442 Elm St., New Haven 11, Conn.



ENTHONE, INC. IS A SUBSIDIARY OF AMERICAN SMELTING AND REFINING COMPANY

ENTHONE



**Don't throw away
those epoxy-coated
rejects**

Here's a new paint stripper that will save them

Do you scrap perfect metal parts that have been imperfectly coated with epoxies, vinyls, polyesters and other hard-to-strip paints or lacquers?

In the last few months, users of Oakite Stripper S-A have eliminated many such losses. Here's what some of them say about it:

CALIFORNIA: An aircraft manufacturer tested many strippers on an epoxy designed to resist attack by hydraulic fluid. Finally found that Oakite Stripper S-A is "the only one that safely strips this paint from anodized aluminum."

NEW YORK: A camera maker coats flash bulb reflectors with black vinyl paint outside and aluminum paint inside. "Stripper S-A is the fastest ever used on our rejects."

OHIO: A maker of toy pistols had trouble stripping alternate coats of lacquer and metallized aluminum. Now "Stripper S-A does it amazingly fast and remetalizing is completely satisfactory."

CALIFORNIA: A producer of metal furniture uses Stripper S-A to remove clear epoxy from plated parts. Chemist says "This is the best stripper on the market."

ALABAMA: A hardware maker had trouble stripping lacquer from brass door knobs. Oakite Stripper S-A now does the work in "less than 1/2 the time taken by any other stripper."

NEW YORK: A manufacturer of business machines tested several strippers on various finishes on steel and aluminum. Verdict in favor of Stripper S-A was: "It's doing a wonderful job."

CONNECTICUT: A maker of brass lipstick shells has found that "Stripper S-A quickly strips epoxy lacquers from rejects and heavily coated work spindles."

CALIFORNIA: A missile maker reports that "Stripper S-A is doing a fine job stripping vinyl from stainless steel and titanium."

FREE Write Oakite Products, Inc.,
18 Rector St., New York 6, N. Y., for
complete information on Oakite Stripper S-A.

Technical Service Representatives in Principal Cities of U. S. and Canada

Export Division Cable Address: Oakite

In our 50th year.



For 59 Years ... L'HOMMEDIEU ...

year after year has manufactured Reliance
Plating, Polishing Equipment, Supplies for
Better and More Profitable Metal Finishing



No. 18 — VARIABLE SPEED POLISHING LATHE

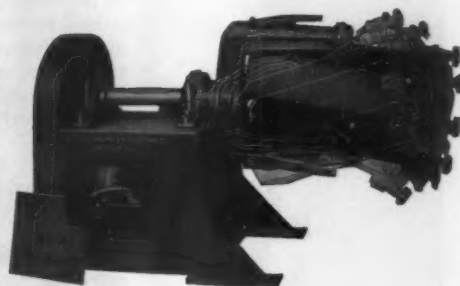
Independent spindles—each with separate patented Variable Speed Drive and controls — ball-bearing throughout. Powered by two up to 15 H.P. motors. Adopted by leading manufacturers as standard equipment.

TYPE L — DOUBLE ACTION BARREL

For ABRASIVE TUMBLING or BALL BURNISHING

The cylinder can be operated at an angle for producing a double tumbling action—thus producing a better and more uniform finish in a much shorter time.

Longer pieces finished more uniformly and without bending.



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A Timely Message on

"Launching Missiles of the Mind"

by Ben P. Sax

Chairman of the Board, American Buff Company

Curiosity and enthusiasm create a potent "fuel" that fires man's imagination . . . launches "guided missiles of the mind" that circle physical objects or mental images in areas as varied as men and their interests. In all ages, minds "orbiting" around individual problems and concepts have produced effective understanding and new solutions for concrete as well as intangible questions.

In the metal finishing industry, our own company has launched many a mental rocket. Visionary conceptions have been projected into practical accomplishment . . . unique tools and methods, which in turn help to provide many of the parts for mighty, mechanical rockets which launch actual missiles, as well as manufacturing economies to bring products within easier buying reach of the mass market.

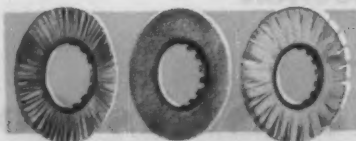
In the thick of today's printed, spoken and electronically communicated information, fresh ideas can the more readily be born, mental stimuli more frequently engendered.

All of us today should concern ourselves with the spread of *more interesting* educational material, revealing to young men and women, and boys and girls, the exciting world which opens from every new avenue of an educated mind. The youth of today can become our greatest pool of future strength, if its appetite for higher education and scientific knowledge is properly whetted.

Sincerely,

Ben P. Sax

"For the job that's TOUGH—use an AMERICAN BUFF"

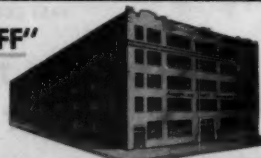


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Pat. No. 2,582,506

World's Largest Manufacturer
of Buffs and Polishing Wheels for
Every Finishing Operation.

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Plant No. 1



Plant No. 2

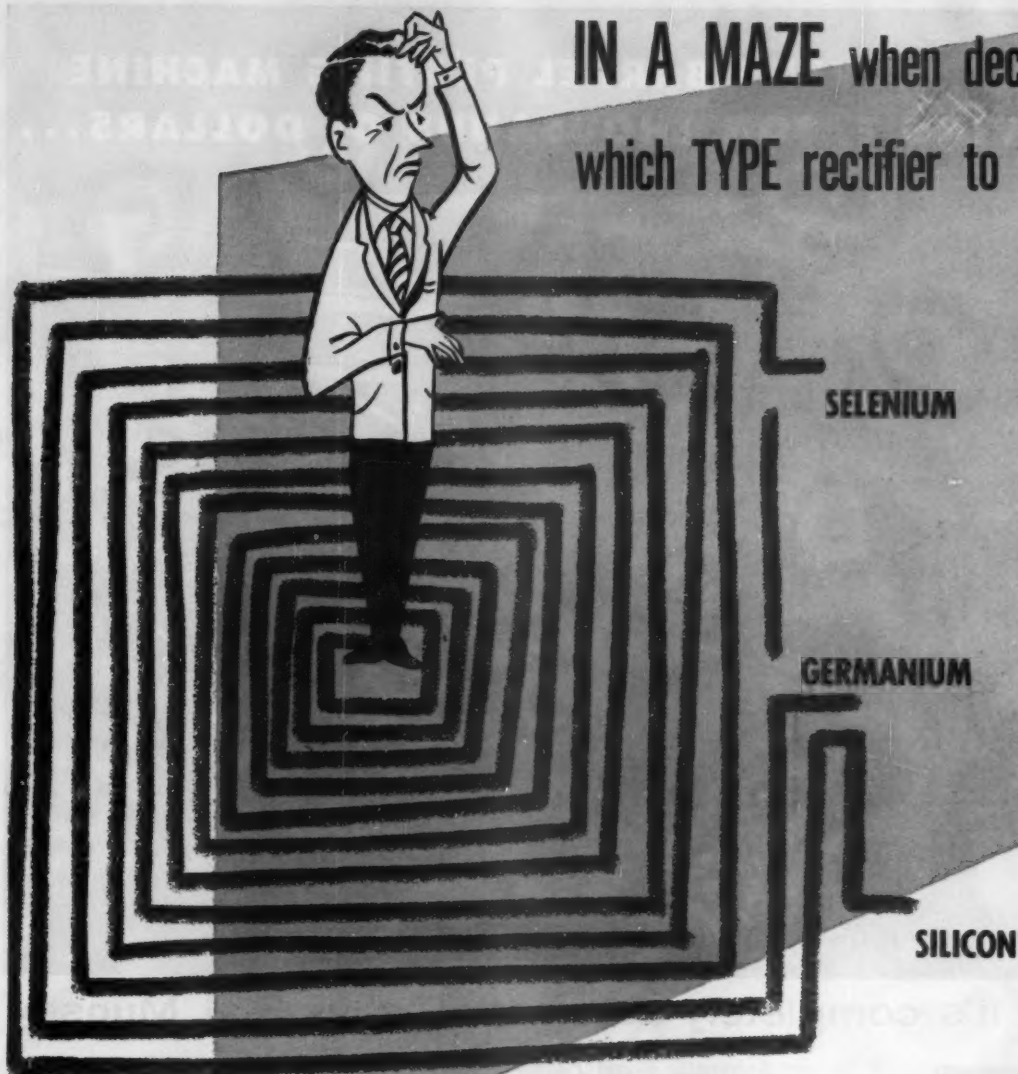
American Buff Company

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Chicago 16, Illinois

AMERICAN BUFFS ARE REGULARLY ADVERTISED IN FORTUNE MAGAZINE

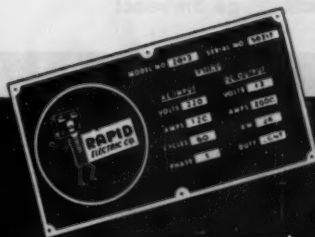
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Why not call RAPID'S engineering department with your power requirements. Let us match your requirements with the right type rectifier.

Because each semi-conductor has advantages to offer, and because RAPID supplies *all three*, you can be certain of obtaining sound technical advice.

Call TA 8-2200 for reliable technical service.



THE NAMEPLATE THAT MEANS *"More Power to You!"*

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"THIS STEVENS BARREL PLATING MACHINE IS SAVING EATON THOUSANDS OF DOLLARS..."



...and it's completely automatic!" says R. J. Munsey



R. J. Munsey
Division Industrial Engineer
Reliance Division
Eaton Mfg. Co.
Massillon, Ohio

A Stevens Automatic Barrel Plating Machine, with *one* operator is cadmium plating 1,750 pounds of lockwashers, Springtites, and Keps an hour for Eaton. It has also . . .

- INCREASED PRODUCTION 270%
- REDUCED REJECTS TO LESS THAN 1%
- REDUCED REQUIRED FLOOR SPACE BY 400 SQ. FT.

These savings, both in supplies and labor, mean volume production for Eaton Manufacturing Co. They've discovered, as have an increasing number of progressive companies, that Stevens equipment assures maximum production and superior quality.

Lower costs, consistent quality and assured production are only a *few* of the reasons why Stevens Automatic Barrel Plating Machines are the leaders in their field. For more details, contact your local Stevens Sales Representative today! Find out why more and more metal finishers are looking to Stevens for production savings.

Remember—When you go Automatic . . . go Stevens!

frederic b.

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NEW HAVEN

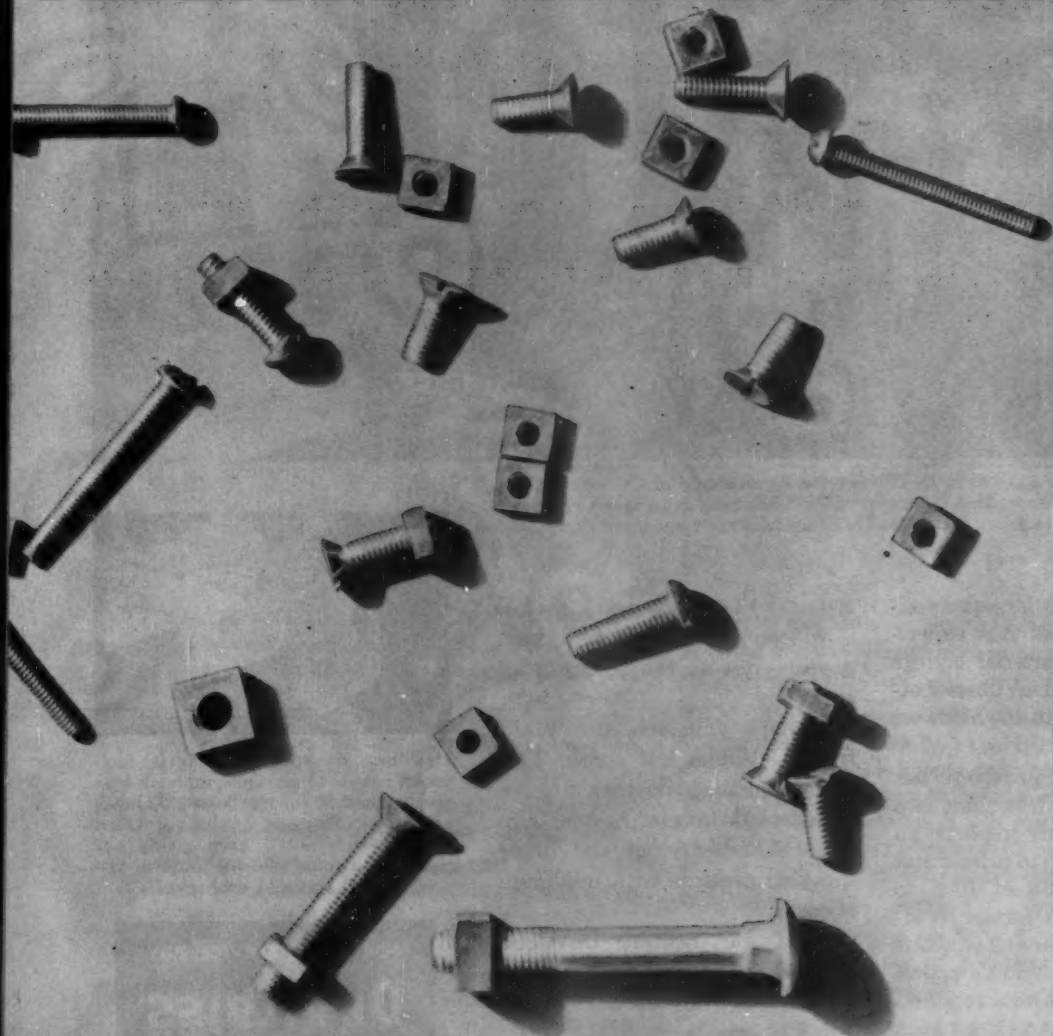
SPRINGFIELD (OHIO)

Your finest work starts with Federated Plating Materials: No Federated plating material is approved for marketing before it has proven its quality through continuing Asarco research. Thus top performance is assured.

This policy of research and testing has rewarded the plating industry with Conducta-Core lead anodes which have greater throwing power, yet last three or four times longer than other lead anodes. Cadmax, addition agent for cadmium plating, is another example of superior materials. So too is Zimax for zinc plating, Nimax, a nickel plating brightener, and new Conmax, a conversion coating for cadmium and zinc plated parts. All do a better job at lower cost.

Your Federated representative or distributor will be glad to document this superiority. And you'll prove it for yourself when you standardize on Federated materials. Federated Metals Division, 120 Broadway, New York 5. In Canada: Federated Metals Canada, Ltd., Toronto and Montreal.

FEDERATED METALS DIVISION OF



AMERICAN SMELTING AND REFINING COMPANY

ASARCO

Federated products for the Plating shop include ANODES: Copper; lead, including the famous Conducta-Core; zinc, tin, tin-lead, cadmium, brass, silver. NICKEL SALTS: Constant quality control assures full nickel content and identical plating characteristics from every lot. PLATING ADDITION AGENTS: Cadmax for still or barrel cyanide cadmium plating; Zimax liquid or powder; Nimax for low cost bright nickel plating; Conmax, a conversion coating, for cadmium and zinc plated parts.

\$75,000 SAVED BY DEVILBISS HOT SPRAY



Refrigerator doors are sprayed in DeVilbiss water-wash spray booth—one of eight such booths in this modern plant. A battery of DeVilbiss remote paint heaters serves the line; each station is equipped with two DeVilbiss heat exchangers and spray guns.

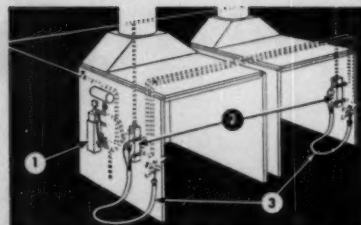
One of the world's largest appliance manufacturers has experienced important material savings as a result of a DeVilbiss hot-spray installation in its Midwest plant.

Although this equipment has been in operation less than two years, the company reports an estimated reduction in primer and enamel consumption of 10% to 15% compared to former cold-spray methods—a saving of about \$75,000 annually! What's more, where spray booths once required

cleaning 13 times a year, this has now been reduced to only 3 times a year—due to the reduction of spray fog.

Perhaps you, too, can profit from DeVilbiss hot spray. This method offers smoother finishes with less shrinkage; heavier film build; faster drying; and lower spraying pressure with minimum overspray!

Call your nearest DeVilbiss branch office today for complete details. Or write direct.



DeVilbiss hot-spray system is fool-proof; adapts to multiple gun hook-ups. Hot water from master heater ① heats paint in exchangers ②; heat-jacketed hose assemblies ③ keep paint hot right up to guns, assuring uniform viscosity at all times at each gun.

THE DEVILBISS COMPANY, TOLEDO 1, OHIO

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FOR BETTER SERVICE, BUY

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*New additive improves
all cyanide
copper and bronze
baths...*

NEOCHEL

M&T NEOCHEL, a compatible liquid formulation, can be used in place of Rochelle salt and proprietary additives to the great advantage of the user.

Improved cathode efficiency . . . Baths containing Neochel plate faster than those containing other available additives.

Higher anode efficiency . . . even at current densities where other additives lose effect rapidly.

Minimizes effect of contaminants. With reducing and chelating action, NEOCHEL cuts effect of chromium contamination, promotes satisfactory deposits.

Cuts cyanide consumption. Higher anode efficiency slows cyanide decomposition and consumption, thereby cutting a major bath upkeep cost.

Retards carbonate build-up. Less cyanide decomposition at anodes means less oxidation and consequently less carbonate.

Smoother deposits . . . because anode corrosion is better; and troublesome hard water precipitates are reduced.

NEOCHEL outperforms anything that's been available to now to improve bath operation. It means more efficient cyanide copper and bronze plating, contributes to better results, helps curb operating problems. Cuts costs, too. It will pay you to get all the facts . . . direct from an M&T plating engineer. Or from our Bulletin No. 158. Send for your copy today.

*Pat. applied for.



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One coat does the job of two with Lowe Feuzon



Here's another example of what can happen when one of Lowe Brothers finishing engineers understands your problem. Check this engineer's report:

"The paint department foreman said that it was necessary to apply 2 or 3 coats for good coverage — especially when the metal had dark spots. He tried an order of Feuzon Gray Metallic and found it covered beautifully with one coat. When he has used up the competitive material in stock, he'll order our Lowe Feuzon."

Lowe Brothers finishing engineers are trained to find ways to cut painting costs. They're experts on paints and finishing methods. Your nearby engineer will gladly make a "flow-chart" analysis of your finishing system. No obligation. Just send the coupon.

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INDUSTRIAL FINISHES

QUALITY UNSURPASSED SINCE 1870



Style-tested paints for Home and Industry

REPRESENTATIVES IN: Chicago, Ill.
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The Lowe Brothers Company
Dayton 2, Ohio

MF-10

☐ Please have my nearest Lowe Brothers Finishing Engineer call on me as soon as possible.

NAME _____

TITLE _____

FIRM NAME _____

ADDRESS _____

CITY _____

ZONE _____

STATE _____



**"DON'T GET CAUGHT
WITH YOUR PLANTS DOWN!"**

Have UDYLITE repair, replace plating barrels NOW...at low cost!

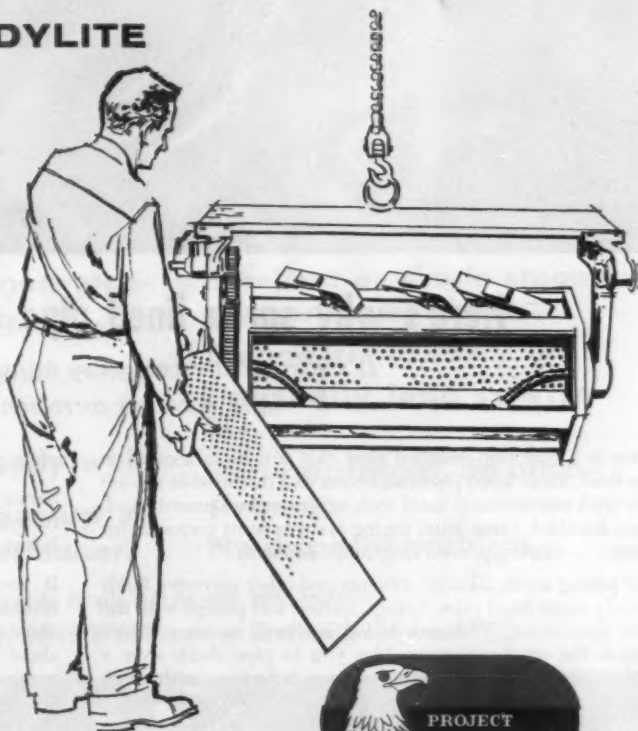
Get ready today for tomorrow's upswing in business! Have your plating facilities geared to peak performance . . . avoid the risk of costly down time during peak periods of production. Take inventory of your equipment needs . . . and the condition of your plating barrel equipment. Then let your

Udylite sales engineer give you on-the-job quotations for repairs or replacements. When your equipment is sent to Udylite . . . you are guaranteed a definite return delivery date. A special department handles your order all the way through . . . costly down time is kept to an absolute minimum.

REPAIRS OR REPLACEMENTS BY UDYLITE OFFER THESE ADVANTAGES:

- 1 IMMEDIATE QUOTATIONS** given by Udylite salesman right in your shop!
- 2 ALL REPAIRS or REPLACEMENTS WITH GENUINE UDYLITE PARTS!** You're assured of finest Udylite engineering, highest quality!
- 3 PARTS FACTORY INSTALLED** by trained barrel equipment specialists.
- 4 FAST, GUARANTEED DELIVERY** of equipment sent to Udylite. Special department set up to expedite your order.

Let Udylite help you get your entire plating operation in top working order, ready to go at top capacity. Your Udylite sales engineer will soon be calling on you. But if you need priority service write, phone or wire directly to:



corporation

detroit 11, michigan • world's largest plating supplier





Here's why saran lined pipe cuts installation costs

*It's easy to fabricate, easy to install at job site . . .
and it resists corrosion for years*

Here is a corrosion-resistant pipe that can be fabricated in the field. Saran lined pipe can be cut and threaded at the job site with conventional hand tools or power equipment. And, once installed, saran lined piping systems resist corrosion for years . . . offering proved long-range economy.

For piping acids, alkalis, solvents and other corrosive fluids specify saran lined pipe, fittings, valves, and pumps with the new gray lining. This new lining anchored under pressure within the steel casing, enables you to pipe fluids over a wider range of temperatures than ever before . . . with maxi-

mum protection from corrosion, plus the strength of steel.

Saran lined pipe, fittings, valves, and pumps are available for systems operating from vacuum to 300 psi, and from well below zero to 200°F.

If your operation can benefit from a *complete* corrosion resistant piping system, write today for more information about saran lined piping components. And be sure to ask about Saraloy® 898 tank lining, too! THE DOW CHEMICAL COMPANY, Midland, Michigan.

SARAN LINED PIPE COMPANY
DEPT. 2001D-2
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FERNDALE 20, MICHIGAN

Please send me information on: ☐ Saran lined pipe, fittings and valves. ☐ Saran lined centrifugal pumps. ☐ Saraloy 898 chemical resistant sheeting.

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Address _____ City _____ State _____

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DOW



Alkalume AC#1 is a safe, easy to use, non-silicated liquid used at low concentration with water. This latest addition to Northwest's outstanding line of specialized chemicals for use with today's modern metals offers these desirable features—

- Non-alkaline, non-etching, non-filming.
- Gives uniform, unblotched brilliance.
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- Ideal as follow-up to heavy-duty precleaner.
- Excellent as single stage cleaner for light soil.
- Economical to use.
- Unusually long service life.
- Non-hazardous, no offensive odor.
- No disposal problem.

Got a Problem?
Let our Cleaning
Specialists
help you!

Complete details will be sent upon request.

"The name NORTHWEST means first with the best."



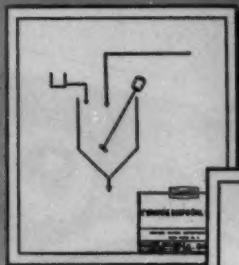
NORTHWEST CHEMICAL CO.

9310 ROSELAWN

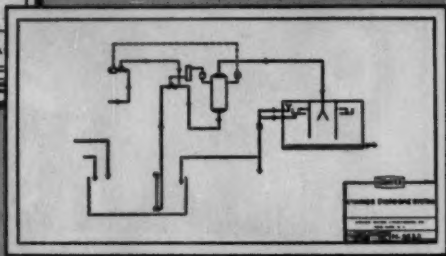
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from simple units...



...to complex treatment plants



GRAVER SYSTEMS ASSURE POSITIVE CYANIDE DISPOSAL

From simple batch units to continuous treatment plants, Graver Cyanide Disposal Systems are engineered to provide— ★ POSITIVE DISPOSAL

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★ MINIMUM MAINTENANCE

★ LASTING ECONOMY

Graver Systems include equipment for oxidation of cyanide to cyanate or complete cyanide destruction by either batch or continuous disposal.

The complete line of Graver equipment for the treatment of cyanide *and all other plating wastes* includes Reactivators®, Rota-Rake® Sedimentation Basins, Ion Exchangers, and specially designed batch treatment units with all controls and accessories.

Whether your problem is cyanide, chromate, acid, alkali or any combination of wastes, Graver know-how, based on years of successful waste treatment experience, will provide the perfect answer in the form of integrated, efficient systems job-engineered to individual plant needs.

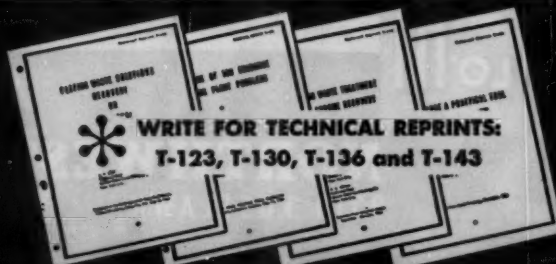
GRAVER

Industrial Waste Treatment Dept. W-521

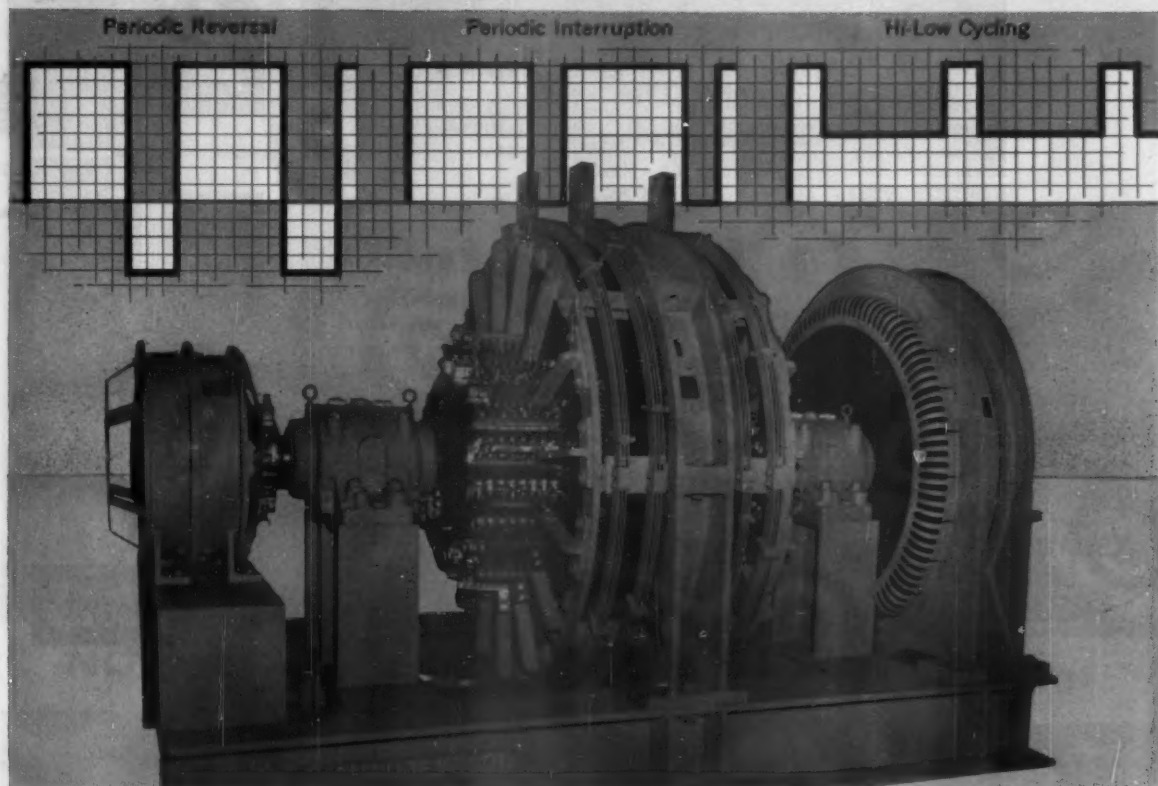
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GREATEST flexibility ... AT THE LOWEST COST



... PROOF THAT MOTOR GENERATORS ARE YOUR MOST ECONOMICAL FORM OF LOW-VOLTAGE POWER

Chandeysson generators keep pace with changing needs of your plating operation.

Throughout the plating industry, companies depend on Chandeysson Motor Generators as their most flexible form of low-voltage power. When plating current must be reversed, interrupted, or changed suddenly, generators do the job at a much lower additional cost than other types of power conversion equipment. Usually, extra control gear costs less than 2% of the original M.G. set price. Comparable changeover nearly *doubles* the cost of other kinds of power conversion equipment.

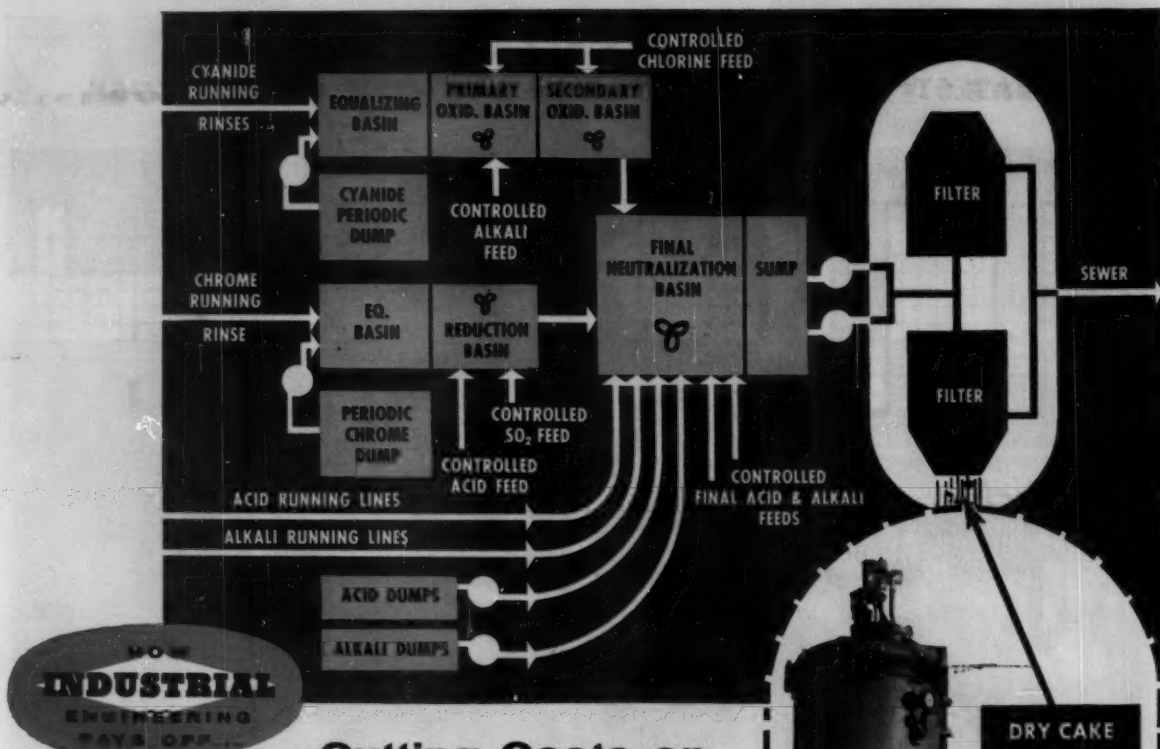
Flexibility is just one of many reasons why the plating industry *insists* on Chandeysson low-voltage generators for direct current power needs . . . for extra capacity to meet emergencies at the lowest possible cost.

For full information, write now for new booklet D-103.

CHANDEYSSON ELECTRIC COMPANY

4074 Bingham Avenue

St. Louis 16, Missouri



INDUSTRIAL
ENGINEERING
SAYS OFF...

Cutting Costs on Plating Waste Disposal

A large midwest plant needed an efficient centralized system for disposal of corrosive wastes from several plating lines.

The answer to their problem was the **INDUSTRIAL** engineered system diagrammed above. This system provides a central basin for neutralization of all the acid, alkali, cyanide and chrome wastes delivered from rinsing operations. Only small amounts of chemicals are added to precipitate the dissolved metals for separation by filtration. The two compact **INDUSTRIAL** filters extract the solids and discharge a neutral non-toxic effluent to the city sewage system.

The end results reduced equipment costs by one-half—two push-button Vertical Leaf Filters replace expensive clarifier mechanisms, sludge pumps and vacuum filter! . . . 90% LESS SPACE required for entire system! . . . SIMPLE INSTALLATION—no excavation or complex concrete work! . . . DRY CAKE WASTE DISPOSAL—discharged by mechanical shakers directly from filters into trucks!



SIMPLE, FAST CAKE DISPOSAL

There's no mess, no time lost with this rapid-cleaning **INDUSTRIAL** filter. A simple mechanical shaker discharges the dry cake through the convenient bottom outlet—directly into a waiting disposal truck that can be driven away immediately.

INDUSTRIAL

**INDUSTRIAL FILTER
& PUMP MFG. COMPANY**

5906 Ogden Avenue, Chicago 50, Illinois

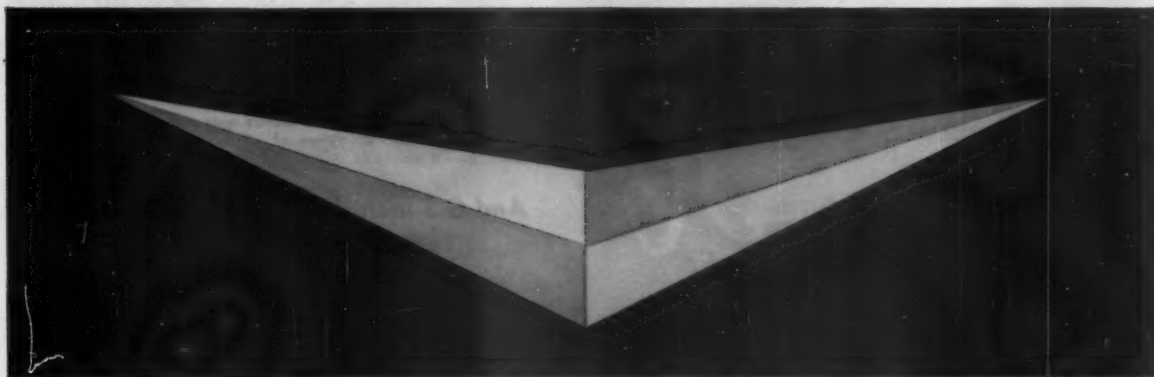
Call or write **INDUSTRIAL** to find out how an engineered system like this can solve your specific plating waste and recovery problems.

F-358

PRESSURE FILTERS ♦ ION & HEAT EXCHANGERS ♦ WASTE-TREATING EQUIPMENT



NOW... light-fast, uniform-colored Aluminum!



PFIZER OXALATES can help you achieve sales advantages in the fast-growing field of colored aluminum.

Oxalates permit you to produce superior gold colored aluminum. Coloring is accomplished by precipitating iron oxide in the aluminum oxide coating from solutions containing ferric oxalate or ferric ammonium oxalate. Shades, from yellow to brown, can be obtained readily by varying the processing technique.

Why not investigate the big profit potential in producing better colored aluminum through the use of **PFIZER OXALATES**. Write for further technical information on Pfizer Oxalates.

Related to this field is Aluminum Company of America Patent No. 2,290,364, and possibly others.

*Manufacturing Chemists
for over 100 Years*

Pfizer

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Chemical Sales Division

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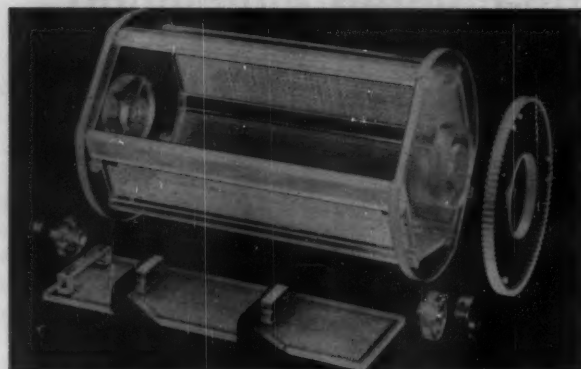
Chicago, Ill., San Francisco, Calif.,
Vernon, Calif., Atlanta, Ga., Dallas, Tex.



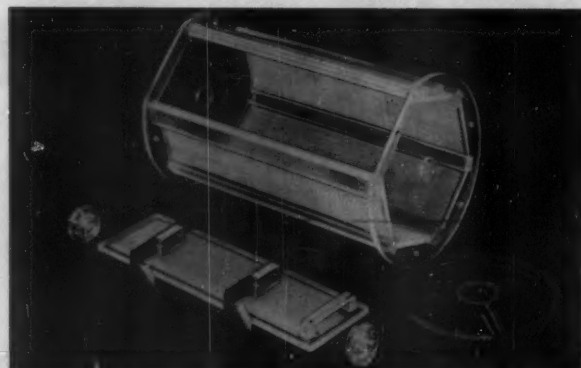
G-S Mod. GS — all sizes — Trussed-Rib (shown) or All-Welded



G-S Mod. SL — all sizes — All-Welded (shown) or Trussed-Rib



G-S Mod. SUN — all sizes — All-Welded (shown) or Trussed-Rib



G-S Mod. SUO — all sizes — All-Welded (shown) or Trussed-Rib

Also, replacement cylinders All-Welded or Trussed Rib (not shown) for all other makes, sizes, types.

REPLACE **NOW** with **G-S** for **Greater Savings!**

Again G-S Replacement Cylinders lead the field by every important measure of value.

Here's the latest comparative chart listing the "big 4" nationally-known plating cylinders made of "composition" materials accepted as standard. See how they rate in the six essential points below. Now you can choose your cylinders on known merit. Insist on G-S and get the best for all your needs.

Replacement Cylinders	Temperatures To 220° F.	Loads To 275 lbs.	Bussed for 1420 amps.	100% Thru-Cycle	All-Welded or All-Bolted	Fit All Makes, Sizes
G-S	YES	YES	YES	YES	YES	YES
"A"	NO	NO	NO	NO	YES	NO
"B"	YES	NO	NO	YES	NO	NO
"C"	NO	NO	NO	NO	NO	NO

The above is based on actual service tests and technical data made public by the manufacturers of all cylinders represented in the chart. Brand names of cylinders A, B, and C available on request.

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Tougher, longer wearing H-T Plexiglas and G-S Polydur (Tempron optional); heavier 2" square ribs for greater strength, better tumbling; scientific perforation pattern, more holes for increased circulation, faster drainage; no formed or molded sections to warp and crack. New G-S "Trussed-Rib" Bolted Cylinder tops them all: 100% replaceable parts, interchangeable in all three materials above, replace any part in 20 minutes with only a ½" wrench, outperforms, outlasts them all. Send for complete information and prices on G-S Replacement Cylinders for all makes, G-S "Cogged-V-Belt" Drive Superstructure Conversions and G-S "Cogged-V-Belt" Drive Plating Barrels. Write The G-S Equipment Co., 15583 Brookpark Rd., Cleveland 35, Ohio.

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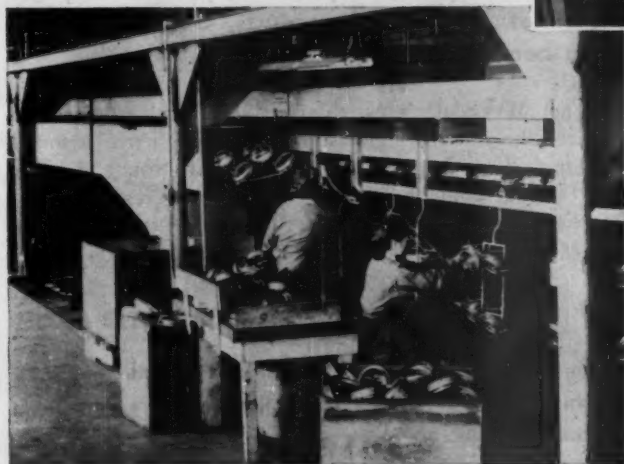
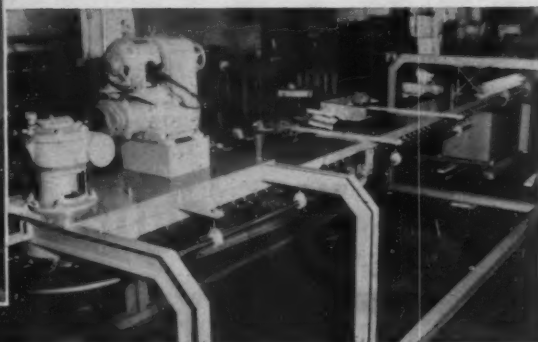
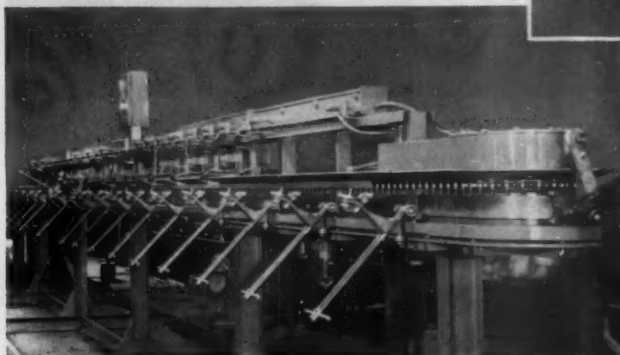
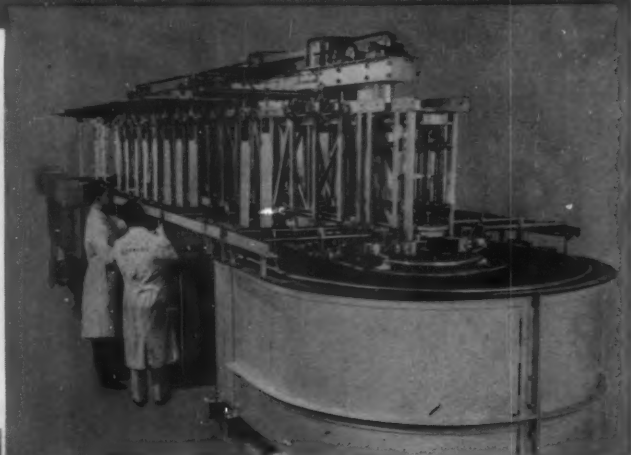
has an automatic for any plating or anodizing operation!

CYCLEFLEX Full Automatic Plating & Anodizing Machine.

Most versatile of all automatics! No overhaul or rebuilding to switch cycles—just a simple moving in positions of pick-up heads and minor changes in tank partitions. Safety controls prevent conveyor breakdowns and load dropping. Many adaptations for any requirement. Low headroom.

SELECT-O-MATIC Multiple Process Plater.

Handles 2, 3 or more process cycles at one time! While loading, operator merely turns dial to select desired cycle for individual racks and the rest is fully automatic! One operator can handle several different processes simultaneously. Saves investment in a variety of machines—reduces floor space requirements—cuts maintenance to a minimum.



DAW JUNIOR CONVEYOR

Fully automatic handling of individual parts. Tailor-made for any production output and any cycle. Tank to tank work transfers raise carriers to above horizontal to prevent solution carry-over, and eliminate air or gas pockets in work. Automatic unloading if work permits.

DAW SENIOR CONVEYOR

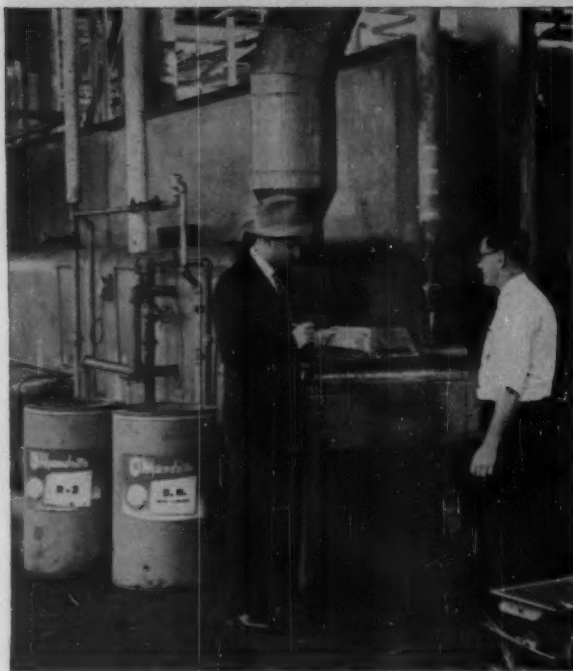
Custom-engineered, fully automatic, for any job, any cycle, any production requirement. Transfers from one tank to another raises work from vertical to above horizontal to facilitate drainage, prevent solution dragout. Handles racks for all sizes and quantities of parts. Automatic unloading unless shape or work size is too large.

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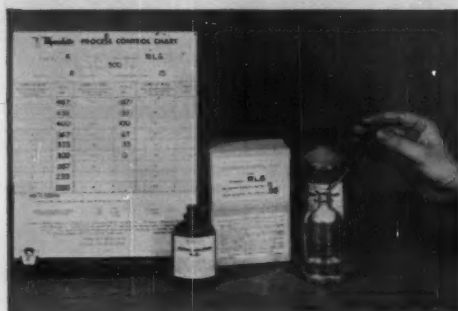


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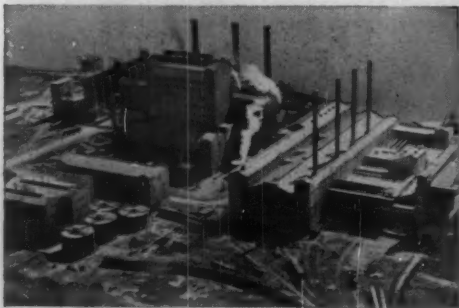


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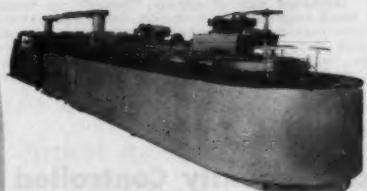


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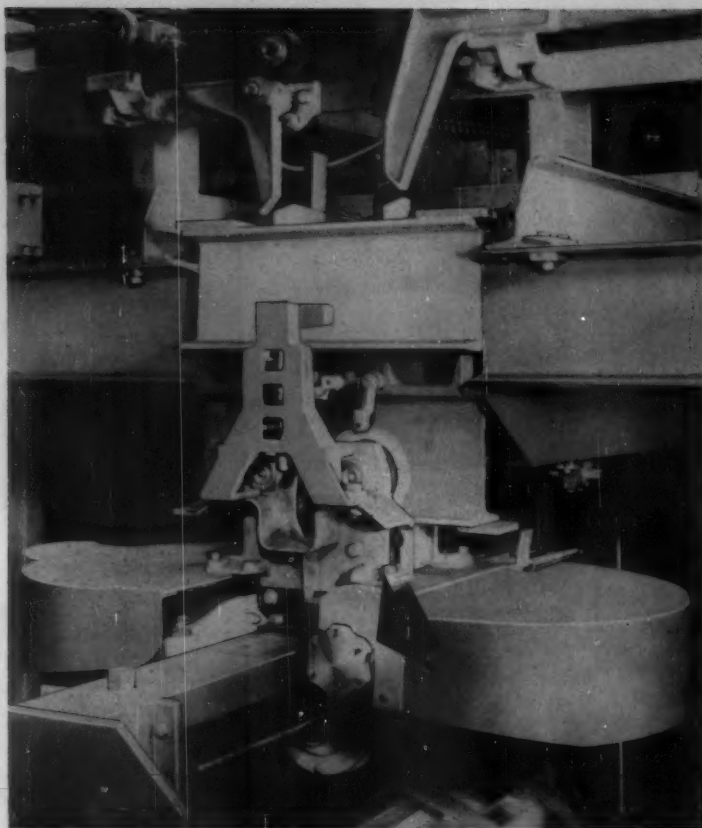
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Separate Processing Cycle
Options-per-Carrier with . . .

ABBEY-MATIC DIAL-CYCLE SELECTION . . .

(left) Outboard side of carrier "locked" on removable main track segment over a station. Interchangeable track segments replacing each other in trackway (up or down). Six-cycle Dial Selector (arrow). Sealed motor under left bumper, sealed worm-gear unit on drive shaft. Slide contacts shielded. (U. S. Patent 2,854,159) and Pending.

How Flexible is Automation? ABBEY-Matic Operates Fleet of Motorized Barrels, Each Independently Controlled by Pre-Set Dial-Selector for up to 15 (and more) Different Routings.

Here is automation's most advanced development. Picture this ABBEY-Matic system in your plant. One man easily outproduces an army of skilled operators. "X" number of carriers with barrels, racks, baskets — or any combination — complete any one of as many as 15 different cycle options each. No manual operations, no manually operated equipment, no manhours!

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ABBEY-Matic Perfected Barrel Operation offers most efficient performance in metal finishing. Dial setting on carrier selects proper route, timing, and movement. Barrel is motorized type with completely sealed motor, frame-mounted under left bumper, with sealed worm-gear drive mounted directly on drive shaft. Electrical contact for motor enters each station and is broken as it leaves station. Thus barrel rotates while lowering or immersing. Permits use of greater plating current while entering bath without danger of "welding" contents. Continuous rotating while raising barrel out of bath minimizes drag-out. Continuous rotating between stations is optional. Takes ambient temperature of 300°F, is corrosion-proof for any plating plant operation.

ABBEY-Matic Carriers Function Independently — robot-fashion — completing pre-determined, dial-selected cycles from "load" through "unload," automatically. Carriers in process stations are by-passed by carriers in transit. All carriers accumulate for unloading as individual processing cycles are completed — without regard for sequence or synchronization. Processing requirements alone determine time of completion with split-second accuracy.

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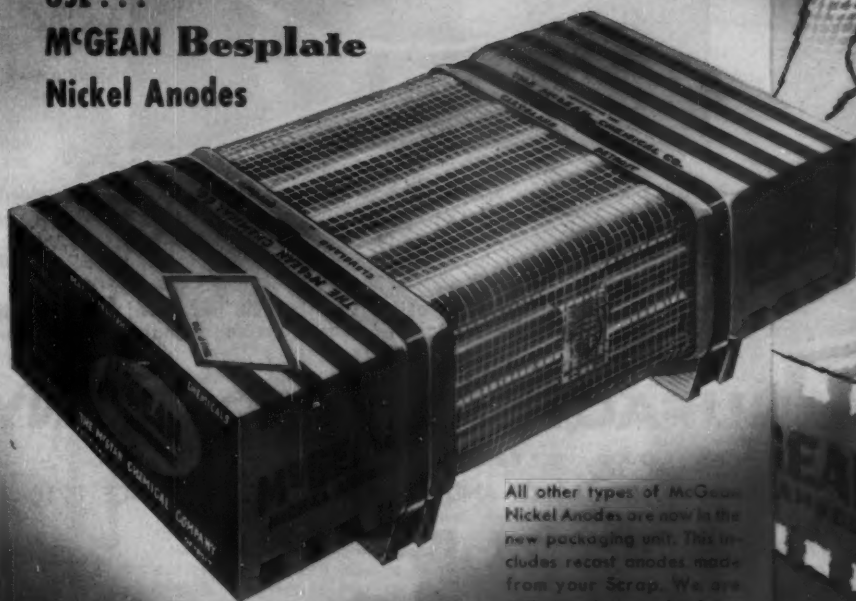
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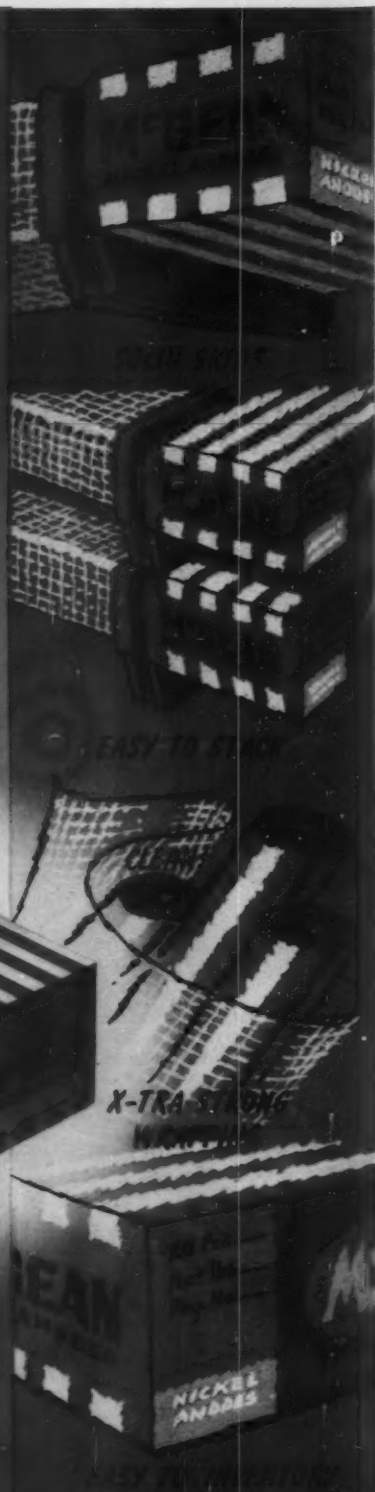
Good as they were, we continued to seek possible improvements and through research we are now pleased to announce two important developments.

- 1 Besplates are now electrolytically treated just prior to shipment in a novel manner providing a chemically clean silvery surface to each and every anode. No longer will there be any need for platers to clean anodes after arrival to avoid introduction of oils, greases or dirt into plating solutions.
- 2 A valuable product deserves an attractive package. McGean now supplies Besplate Nickel Anodes in a handsome container, so designed to deliver in perfect condition those chemically clean anodes produced in our new process. The container is strong, contents well marked, capable of easy stacking for storage and a real space saver. Your Plating Department is sure to approve of the neat, clean manner in which McGean Besplate Nickel Anodes reach your plant.

USE... **McGEAN Besplate Nickel Anodes**



All other types of McGean Nickel Anodes are now in the new packaging unit. This includes recast anodes made from your Scrap. We are skilled in the art of refining and casting Scrap Nickel.

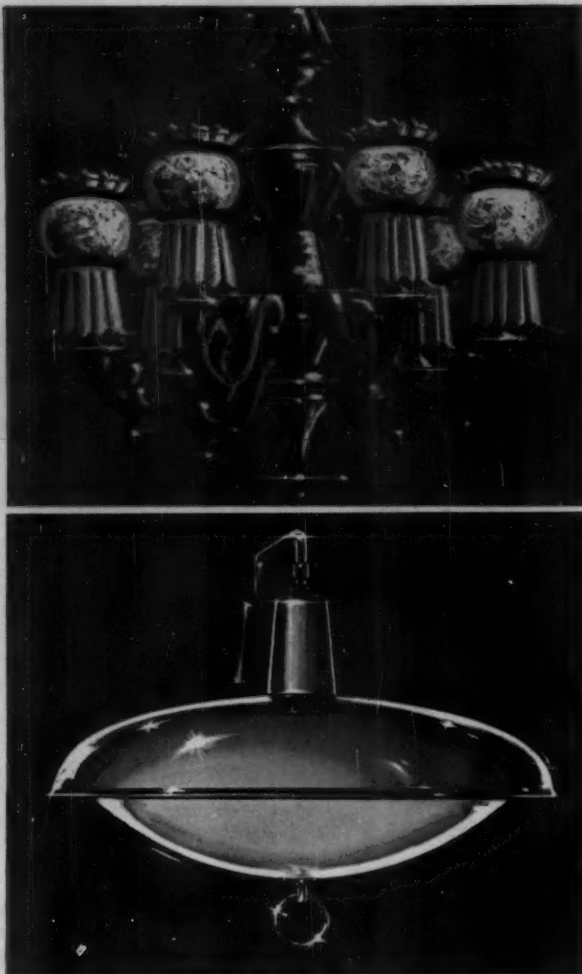


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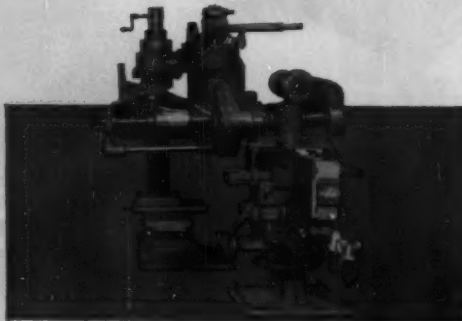
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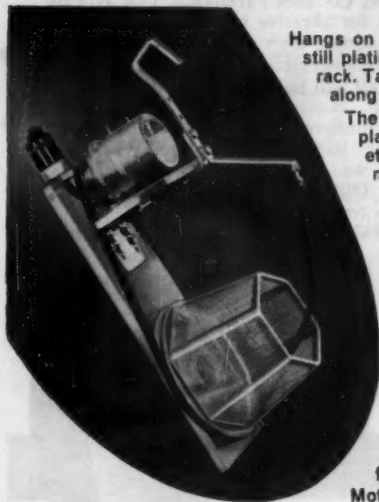
Acme special semi-automatic machine with E-10 oscillating fixture arrangement used with Acme G-3 buffing lathe. One operator normally handles two units for most efficient production.



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PROBLEMS

More ways to cut costs

BELKE Rack-Mounted Barrel Plater



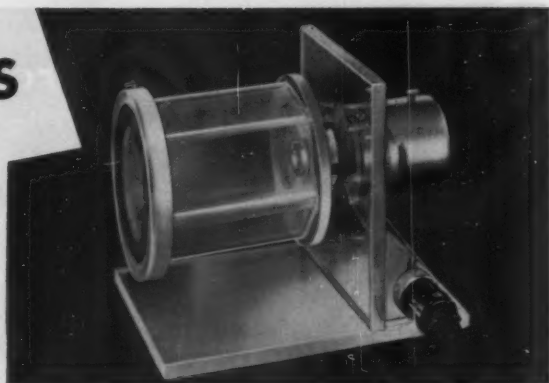
Hangs on the cathode rod in a still plating tank like a plating rack. Takes only 6 to 7" space along the cathode rod.

The quick easy way to plate small lots, samples, etc. with no delay; and no production tie-up.

Plates any quantity from a spoonful to a pint in practically any plating solution. Just lift out of the tank and pour the work out; reload and hang on the cathode rod.

Cylinder inside dimensions: 4 1/4" deep, 4 1/4" at small end, 5 1/4" at large end. Standard perforations, 1/32".

Motor, 115V, 60C, 1 phase.



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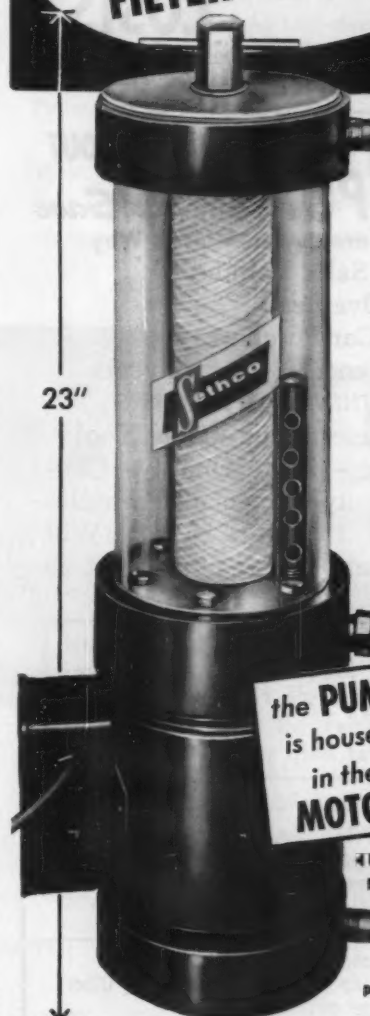
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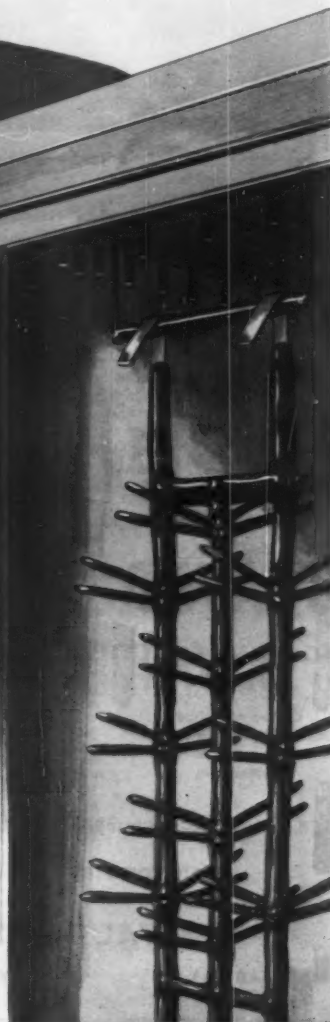
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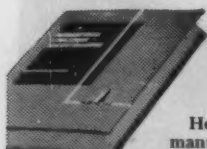
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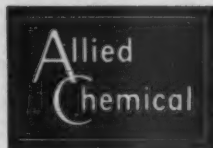
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MUTUAL chromium chemicals are available through dealers and SOLVAY branch offices located in major centers from coast to coast.

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Send for this bulletin. It contains information on the full line of Mutual Chromium Chemicals.

Solvay Process Division
Allied Chemical Corporation
61 Broadway, New York 6, N. Y.

Dept. 9

Please send me Bulletin #52—"Chromium Chemicals."

NAME _____ TITLE _____

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PROMAT: YOUR BEST SOURCE OF FINE CHEMICALS AND PROCESSES IN METAL FINISHING

HERE'S WHY

For almost twenty years PROMAT has been supplying the metal finishing industry with the finest in chemical products and processes relating to the finishing treatment of metals.

PROMAT manufactures an unexcelled line of ZINC BRIGHTENERS, CADMIUM BRIGHTENERS, ELECTROPOLISHES, ANTI-FOAM AGENTS, DOCTOR'S SOLUTION, CLEANERS, RUSTPROOFERS, and CHROMATES.

PROMAT'S achievements in CHROMATE PROCESSING are well known and include a variety of applications such as single or double dip processes, brighteners, and O.D. colors available for ZINC, CADMIUM, and ALUMINUM.

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is yours for the asking from PROMAT'S service department where highly skilled technicians stand ready to serve you in the solution of any metal finishing problem you may have.

To obtain technical bulletins relating to any of PROMAT'S fine line of chemicals, or to receive PROMAT'S monthly publication "Progress," write to



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DIVISION
POOR and Company
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WAUKEGAN, ILLINOIS**

PROMAT'S products are manufactured in the United States, Canada, Great Britain and West Germany, and sold throughout the free world. PROMAT'S manufacturing plants in the United States are located in Waukegan, Illinois and Gardena, California.

What's in your plating bath?

One thing for sure, you can't tell just by looking at it. If you're shooting for smooth production and top quality work, analyze your bath at regular intervals and add only the correct amount of the proper ingredient required.

Control your solutions with KOCOUR TEST SETS. Kocour Test Sets provide the simplest and most direct analysis . . . they're easy to use and they're complete with reagents and glassware.

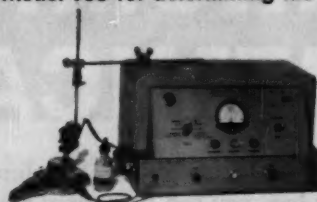
. . . . For every plating purpose



Kocour Test Sets are available individually or in economical combinations for the control of plating, cleaning, pickling, anodizing, sealing, coating, passivating, desmutting, deburring, phosphorizing, heat treating, pH control and thickness testing. Write for your FREE copy of "Lab Hints for the Plater."

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virtually automatic
direct readings
simple operation

Model 955 determines the thickness of heavy or decorative chromium, silver, tin, cadmium, zinc, brass, copper, nickel, lead and other alloy deposits on various basis metals. Write for descriptive Bulletin 400 . . . and ask for a demonstration or 15-day Free Trial.

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CHICAGO 32, ILLINOIS
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HARSHAW PRESENTS

2

new, outstanding

BRIGHT COPPER
PLATING PROCESSES

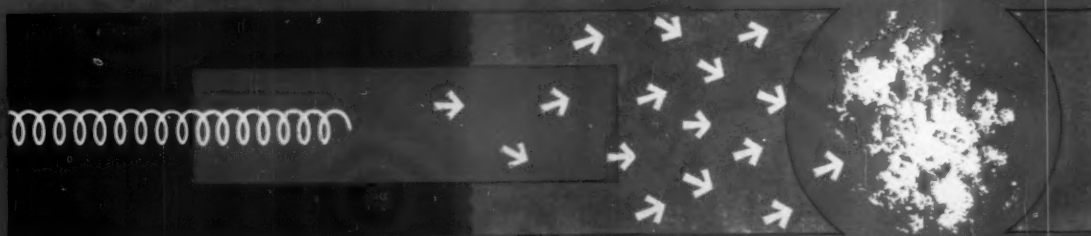
HARSHAW CYNOREX

Copper Plating Process
(High Speed Copper Cyanide)

The Harshaw CYNOREX copper process is a new high speed copper cyanide bath which produces a bright and ductile copper by the use of a single addition agent designated as CYNOREX No. 1. It has many advantages including unusual brightness; a smooth fine grain and ductile deposit; stability; high efficiency; economical operation; and high tolerance to metallic impurities. The process can also be operated with air agitation.

The CYNOREX process is easy to maintain and operate because it has only one brightening addition

agent. It is a non-metallic addition agent which is very stable and is not removed by carbon circulation. Since the brightener is not removed by carbon and the cathode and anode current efficiencies of the bath are 100%, operational costs are kept to a minimum. Because of the stability of the single brightening addition agent, the CYNOREX bath will produce satisfactory bright deposits even after extremely long periods of shutdown. A compatible wetting agent is available where operating conditions dictate its use.



HARSHAW CUPREX

Copper Plating Process
(Acid Copper)

Among the advantages of the new CUPREX acid copper process are its superior brightness, excellent leveling, ductility, and stability. Also, the bath can be operated not only as a still or cathode rod agitated solution but also with air agitation. Another distinctive advantage of this process when operated still or with cathode rod agitation is that a cyanide copper strike is not required for adhesion of the copper to the base metal. As an air agitated solution the normal copper or nickel strike is required. The bath has indefinite operational life and therefore, the problem of treatment cleanups is at a minimum. In this respect CUPREX is superior to other bright acid copper plating processes.

The bright throwing power of the CUPREX copper bath is superior to any competitive acid copper plating solution. The deposit is the most easy to buff of any acid copper plate because of its great leveling and hiding power. Nodular build up in all instances is characteristically at a minimum.

The CUPREX process yields a deposit having a high ductility thru the entire range of conditions and compositions used to vary the deposit from an excellent semi-bright to the fully bright appearance so easily obtained.

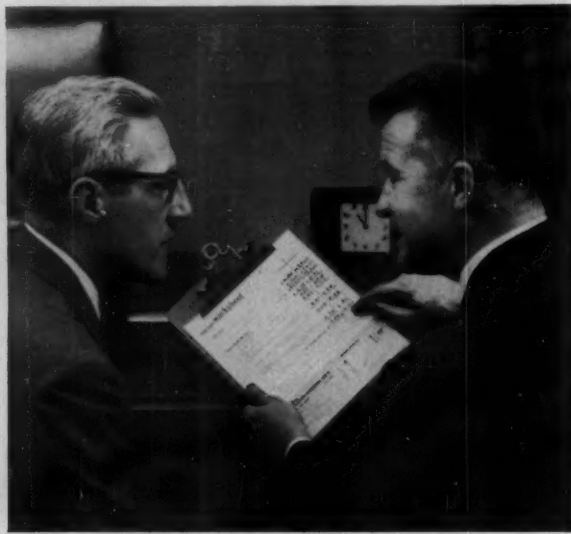
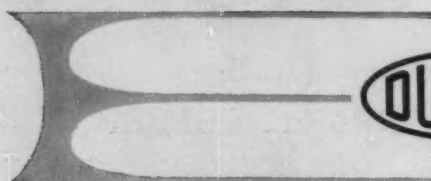
Each of these new outstanding Harshaw Bright Copper Plating Processes has certain unusual characteristics which fit into the product finishing requirements in your plant.

Contact the Harshaw Branch nearest you. Harshaw representatives will be happy to discuss with you the application of these processes in your plant.

The Harshaw Chemical Co.

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EXCLUSIVE "HIGH-SPOT" WORKSHEET is used by Du Pont Technical Representative in helping you make a cost analysis. He'll help you determine required data on investment and operating costs . . . can usually work out the results in one hour or less. Call your distributor of "Triclene" D trichlorethylene today for this unique Du Pont service!

Now . . . analyze your metal cleaning costs in one hour or less!

**Exclusive Du Pont "High-Spot" cost analysis gives you facts
you need to meet competition and rising costs**

With Du Pont's new "High-Spot" cost analysis method, you'll be able to price the cleaning of new parts more accurately . . . find out where your present metal cleaning costs are out of line—see how you can clean metals more profitably. This unique method was developed by Du Pont to give you a quick, reliable way to pinpoint your *complete* costs of cleaning—not just the obvious (and often misleading) costs of the solvents or chemicals alone.

The need for accurate analysis

Competition and rising costs make it necessary for all fabricators to analyze

manufacturing costs accurately. Du Pont's exclusive "High-Spot" method—a condensation of Du Pont's original, more comprehensive cost analysis—gives large, medium and small firms an easy way of getting vital answers to meet changing production demands.

In one hour or less— the answer and direction

"High-Spot" helps you make an analysis of your present cleaning costs . . . or a side-by-side comparison of competitive cleaning methods handling the same job . . . in one hour or less. With the results

of the analysis, you can frequently find ways to trim out-of-line costs, or select the most efficient process if you're expanding.

Planning a new product or part?

Let a "High-Spot" cost analysis take the guesswork out of estimating that new job. As with all our Technical Services to fabricators, "High-Spot" is available through your local distributor of "Triclene" D trichlorethylene. Call him today. He'll arrange for a Du Pont Technical Representative to help you with a "High-Spot" cost analysis. It may point the way to saving thousands of dollars.



Get facts about "High-Spot" cost analysis from your Du Pont Technical Representative.

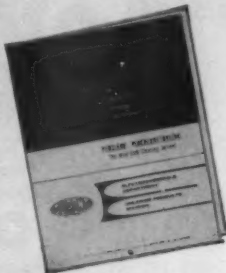
This folder contains the actual form used in a "High-Spot" analysis . . . explains the method . . . lists facts needed to do an analysis. Ask your distributor of "Triclene" D to have a Du Pont Technical man explain this new Du Pont service, or check the box in the coupon at right.

FOR MODERN METAL CLEANING

New Du Pont report tells why "Perclene" perchloroethylene is the ideal solvent for cold cleaning

You'll find this authoritative Du Pont report extremely useful if you do any cold cleaning of metal parts, motors and other maintenance operations, etc. It's a factual, straightforward presentation of basic information about the properties of various solvents now used for cold cleaning.

This new Du Pont report shows why "Perclene" perchloroethylene is superior to other cold cleaning solvents in safety . . . is less expensive . . . is inherently stable and so can be repeatedly reclaimed by simple distillation. It further shows why "Perclene" cleans better in many cases because of its slower rate of evaporation.



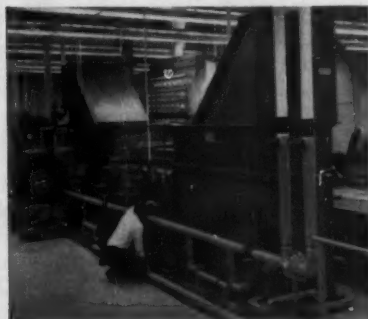
Of particular interest to safety engineers and production supervisors are the safety advantages of "Perclene". One easy-to-read table compares the vapor concentrations of "Perclene" perchloroethylene with methyl chloroform in typical cold cleaning applications. These concentrations are expressed as percentages of Maximum Allowable Concentration (MAC) of the solvents compared and show the greater safety of "Perclene" in most cold cleaning applications.

If you have any cold cleaning operations, you'll want this new report. Ask your distributor for a copy, or mail coupon below.

Here's how you profit by buying Du Pont TRICLENE® D: *you profit because you stay in the lead!*

For over 32 years progressive fabricators have profited from Du Pont research on vapor degreasing—research aimed at developing solvents and methods that insure high-quality, low-cost cleaning. Buyers of Du Pont "Triclene" D trichloroethylene stay ahead of their competitors because they are the first to realize the cost and quality advantages of the solvent which is years ahead. In addition, they are first to enjoy the benefits of new developments from Du Pont.

Just look at the record:



Plant-scale conveyorized vapor degreaser is used to study metal cleaning problems at new Du Pont laboratory. Extensive equipment is also used to develop improved degreasing techniques.

1925—The first American-made trichloroethylene is produced at Du Pont's Niagara Falls plant.

1926-28—The first stabilized trichloroethylene is developed at Niagara Falls and used in the first American-built vapor degreasers.

1933-47—Du Pont trichloroethylene is used in virtually all of the vapor degreasers operating in this country!

1949—Du Pont announces a revolutionary new concept—neutral stabilization of trichloroethylene for metal degreasing.

1954—Du Pont makes still another major breakthrough in stabilization technology by introducing the new "Triclene" D—now the nationally accepted standard for superior performance in degreasing-grade trichloroethylene.

1959—Du Pont will introduce nationally two new metal finishing processes.

(1) A vapor-degreasing trichloroethylene painting process that cleans and paints metal work in a single piece of equipment.

(2) A trichloroethylene based process for "Dry" phosphatizing.

When you buy Du Pont "Triclene" D, you get not only the best degreasing solvent, backed by experienced technical service, but also the latest process-improving developments. *You profit because you stay in the lead!*

Your distributor of "Triclene" D trichloroethylene can supply your requirements. Just give him a call, or mail the coupon below.



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... THROUGH CHEMISTRY

☐ I'd like to know more about "High-Spot" cost analysis

☐ Send me report on "Perclene" for cold cleaning

☐ Send me booklet on Vapor Degreasing

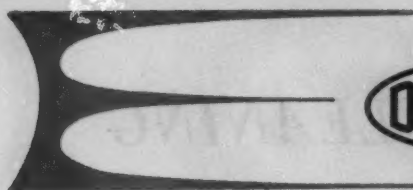
E. I. du Pont de Nemours & Co. (Inc.)
Electrochemicals Department, MF-10
Wilmington 98, Delaware

Name _____ Position _____

Present method of cleaning _____

Address _____

City _____ Zone _____ State _____



PLATING SPECIALIST AT NEW LABORATORY (above) studies copper anode corrosion in transparent plating tank. Du Pont specialists are constantly searching for new ways to improve copper-plating techniques. (Left) New \$2 million laboratory houses the latest plant-scale equipment to help insure practical solutions to production problems.

New Du Pont Laboratory helps solve customer problems ...researches new copper-plating processes

Plating problems are a major consideration at Du Pont's new Sales Technical Laboratory. Here, trained specialists use full-scale plating equipment to work out practical answers that can help you improve copper-plating quality, speed production, cut costs.

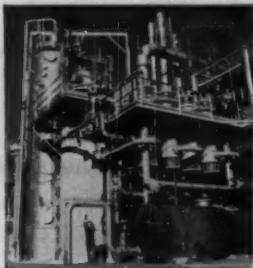
Research in plating techniques and processes is another important activity at the new lab. This continuing Du Pont research has resulted in a new high-speed cyanide process for bright-copper plating on steel parts and zinc die castings. This new process has been thoroughly field-tested, and is producing high-quality results on such parts as automobile bumpers and grilles, hardware products and wire.

Another Du Pont development now

undergoing tests and refinements is a new technique for plating level copper on polished-steel parts. This new process promises to eliminate unracking, buffing and cleaning prior to nickel and chromium plating on many different types of parts. The level-copper process holds considerable promise for the plat-

ing of zinc-based die castings for smoother, more uniform deposits with excellent hiding power.

Ask your Du Pont Technical Representative for more details about these new plating developments resulting from Du Pont research, or about any of the products on the opposite page.



MODERN PLANT ASSURES DEPENDABLE SUPPLY OF QUALITY PLATING CHEMICALS

Du Pont plant at Memphis, Tenn., is now producing highest-purity sodium cyanide and potassium cyanide to meet your plating requirements. Example: Du Pont potassium cyanide is 98% minimum pure with .0003% maximum sulfides (as sulfur). You can order mixed shipments... save time, money, storage space.

FOR BETTER COPPER PLATING

Du Pont research results in Copper-Plating Chemicals that help you speed production, improve quality



Pre-mixed for your convenience —unique Du Pont double salt

This new salt developed by Du Pont combines high-purity Du Pont Cyanobrik® sodium cyanide and copper cyanide into *one* convenient copper-plating chemical for both bath make-up and replenishment. It saves time, cuts down handling of chemicals for greater safety, reduces errors because ingredients are already in the proper proportions required by bath.

SPECIFICATIONS

Copper.....	28.7% min.
"Free" sodium cyanide.....	0.4% to 2.0%
Lead.....	7 ppm. max.
Sulfides as sulfur.....	10 ppm. max.
Insolubles.....	0.01% max.

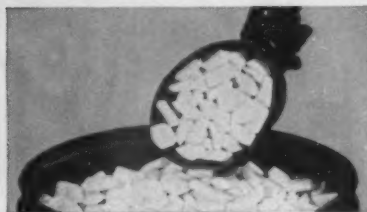
TYPICAL ANALYSIS

Copper.....	29%
"Free" sodium cyanide.....	1%
Lead.....	Less than 1 ppm.
Sulfides as sulfur.....	Less than 5 ppm.
Insolubles.....	0.01%

Du Pont Copper Cyanide— regular plating tests insure quality

With Du Pont Copper Cyanide your benefit is in low unit costs that result from savings in time, labor and overhead charges. For example, Du Pont Copper Cyanide readily dissolves in cyanide solutions without introducing inert salts into the plating bath. In addition, you get faster plating with high current density and rapid metal deposition.

Du Pont guarantees a copper content of 70.0% min. and a cyanogen content of 28.5% min. As a further guarantee of the quality of Du Pont Copper Cyanide, regular plating tests are conducted by Du Pont to insure maximum performance.



Du Pont Cyanobrik® now guaranteed 97% min. sodium cyanide

New high-purity "Cyanobrik" sodium cyanide specifications guarantee a higher minimum cyanide content, which can result in a lower net cost for your active cyanide. Automatically, maximum permissible impurities are lowered. This means that you get a full extra pound of active cyanide per 100 lbs. of "Cyanobrik."

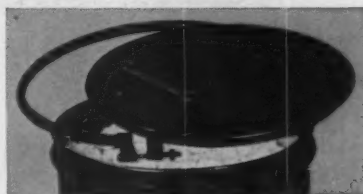
You can count on the uniform high quality of "Cyanobrik" for even the most critical plating jobs. The negligible sulfide content makes Du Pont "Cyanobrik" particularly suitable for use in sulfide-sensitive electrolytes, such as proprietary bright-copper baths.

SPECIFICATIONS

Sodium cyanide.....	97% min.
Sodium chloride.....	0.2% max.
Sulfides (as sulfur).....	0.0005% max.

TYPICAL ANALYSIS

Sodium cyanide.....	97.5%
Sodium hydroxide.....	0.4%
Sodium carbonate.....	1.5%
Sodium formate.....	0.35%
Sodium chloride.....	0.1%
Water.....	0.15%
Sulfides (as sulfur).....	0.0004% (4 ppm.)



Drum head comes off quickly with a few turns of a wrench.

Easy-opening, reclosable drums simplify handling of "Cyanobrik" sodium cyanide

Both 100- and 200-lb. net steel drums for "Cyanobrik" sodium cyanide are nonreturnable open-head steel drums. A few turns of a wrench open the drum. It closes just as easily, giving full protection to partially used contents during storage.

FOR MORE INFORMATION about any or all of Du Pont's full line of high-quality products for copper plating, just give your Du Pont distributor a call, or write your nearest Du Pont District Office listed below.

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Baltimore 2.....	321 Fallaway
Boston 10.....	140 Federal St.
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Detroit 35, 13000 W. Seven Mile Rd.	
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Los Angeles Box 70, El Monte, Calif.	
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Philadelphia.....	308 E. Lancaster Ave., Wynnewood
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This factor alone can mean real year 'round power savings in your plating operation! For Example: Operating ten hours a day, six days a week, 10,000 ampere germanium power supply will save 912 KWH per week over a silicon unit of the same rating. An annual savings in power dollars amounting to \$943.48! These figures are based on an estimated national average cost of \$.02 per KWH. If you pay more... you'll save more!



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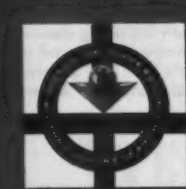
This assures low
current density in the crystal
despite the extremely high current
rating. Result: Added capacity in
cases of over temperature and
overload.

THE CAST ALUMINUM airfoil
housing removes heat at optimum
rate. It prevents failure from over-
heating—a major cause of break-
down. Exclusive construction design
makes this rectifier highly resistant
to corrosive atmospheres.

THE 93.2% EFFICIENCY attained by
this junction is the highest ever,
resulting in marked power savings
over other types, according to
actual records of typical plating
supply manufacturers.

FOUR YEARS OF THOROUGH
TESTING and use in leading electro-
chemical plants throughout the
world prove its exceptional reliability.

TO SUM UP: In terms of efficiency,
size and initial cost—this germanium
rectifier junction is absolutely the
best for any plating application,
from 1,000 to 200,000 amperes!

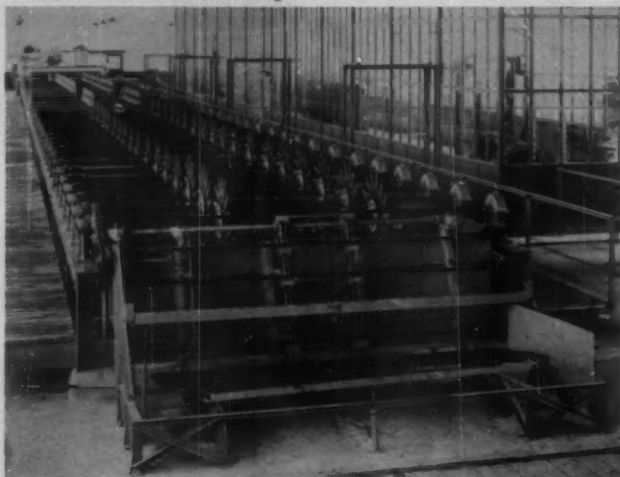


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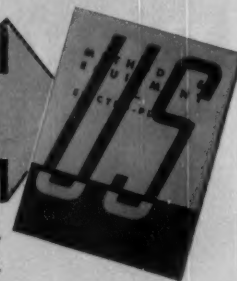
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OCTOBER, 1958

Volume 56 Number 10

FEATURES

Thomas A. Trumbour — In Memoriam	45
Applications for Alkaline Descaling Cleaners	46
By Edward R. Jorczyk	
The Sulphur Dioxide Test	49
By J. Edwards	
Science for the Coatings Technologist — Part XI	56
By E. S. Beck	
New Painting Facilities Effect Production Economies	61
By Bert Goldrath	
Pores and Pitting of Plated Deposits	64
By Dr. J. M. Odekerken	
Electropolishing — Less Commonly Electropolished Metals	67
By John F. Jumer	
Electrochemical Society Meets in Ottawa	68
The Use of a Coulometer	71
By J. B. Mohler	
Phosphating Treatments — Part VII	72
By Ervin C. Tinsley	
Science for Electroplaters — Part XLI	74
By L. Serota	

DEPARTMENTS

Shop Problems	77	Manufacturers' Literature	114
Patents	79	Associations and Societies	116
Abstracts	81	New Book	118
Recent Developments	84	News from California	118
Business Items	100	Obituaries	119

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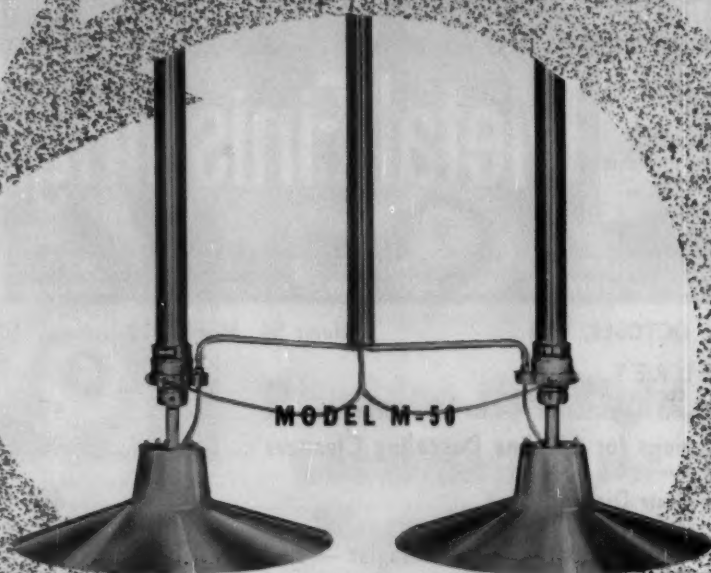
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Thomas Anthony Trumbour
1883 - 1958

Metal Finishing

POLISHING AND BUFFING • BARREL FINISHING • CLEANING
PLATING • ANODIZING • RUSTPROOFING • LACQUERING & ENAMELING

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The plating and metal finishing industry lost a great friend in the death of *Thomas A. Trumbour* on September 2nd. Tom, as he was affectionately and widely known, had devoted his entire life to *Metal Finishing* and its predecessor publications, having started with the paper when it was known as the *Aluminum World*, in September 1901. This was his first employment and, had he lived a few weeks longer, Tom would have completed fifty-seven years of service with one organization.

His life story is a record of progress and events in the metal finishing industries. Born in Butler, N. J. in 1883, Tom attended MacChesney's Business College in Paterson and, on graduation, went as secretary with the struggling journal published by the late *Palmer H. Langdon* in New York. At that time the aluminum field was not large enough to support a publication so, in 1903, the name was changed to *Metal Industry*, embracing all the non-ferrous metals. Little by little, and largely as a result of Tom's efforts, the journal became concerned with the finishing end of the metals field. In 1914 he participated in the meetings which launched the *American Electroplaters' Society*. At this time their first national convention was held and, from this year on, Tom never missed a national convention of this group. In 1925 he attended the first meeting of the *International Fellowship Club* as one of the founders. This group is now the *Metal Finishing Suppliers' Association*. In 1929 he was elected to office in this organization which he held up to the present.

In 1930 Tom urged the publication of a *Guidebook* for the benefit of the rapidly growing plating field. In 1940 *Metal Industry* became *Metal Finishing*, and, henceforth, the paper devoted all its attention to the field in which Tom had been so active.

In 1956 he was elected an honorary member of the A. E. S.

Tom was a foremost citizen of Hawthorne, N. J. where he resided many years with his wife, the late *Elizabeth M. Trumbour*. He was a member of the Holy Name Society of St. Anthony's R. C. Church, a charter member of the Knights of Columbus Council in Butler and in 1956 he was elected an honorary member. He had been a director of the Progressive Savings and Loan Association for several years.

Surviving are two sons, *Thomas H.* and *John E.*; four daughters, *Mrs. Dorothy Tschopp*, *Mrs. Joan Wiarda*, *Mrs. Elizabeth Meyers* and *Mrs. Frances Drennan*; two sisters, a brother, sixteen grandchildren and ten great-grandchildren.

The publishers of *Metal Finishing* want to acknowledge with sincere thanks the many expressions of sympathy received during the past month.

Applications for Alkaline Descaling Cleaners

By Edward R. Jorczyk, B.A., M.A., Process Engineer, Lycoming Division, AVCO Mfg. Corp., Stratford, Conn.

Introduction

RELATIVELY new and gaining popularity in the plating and metal finishing industries are the alkaline descaling cleaners. These versatile cleaners, when properly used, will remove rust, heat treat scale, smut, oxides, stains, paint, and a variety of other soils from ferrous base alloys. Equipment may vary from a simple soak tank to an electrified tank utilizing electronic periodic reversing current controls, depending upon the nature of the soil that is to be removed from the basis metal. Temperatures, as well as concentrations of the solution, also vary and each must be determined experimentally as to the optimum conditions for a specific application. Often, one set of conditions is suitable for a variety of applications.

The advantages of this type of cleaner are many. Since the cleaner is alkaline in nature, tolerances of finished machined parts, gauges, etc., are not disturbed. In many instances, acid pickling or abrasive blasting can be eliminated. When used in conjunction with a vapor degreaser in a cleaning line prior to plating, hot alkaline cleaners and acid pickles may be eliminated. Hydrogen embrittlement, normally encountered in acid

pickling, poses no problem when the cleaner is used as a soak or with reverse current, because there is no hydrogen generated on the part being derusted or cleaned. There is some question as to whether or not serious hydrogen embrittlement does occur, when the cleaner is used with direct or periodic reverse current. Since hydrogen is evolved during the cathodic cycle, the possibility of embrittlement does exist. Fatigue tests can be conducted to determine whether or not serious hydrogen embrittlement occurs under these conditions.

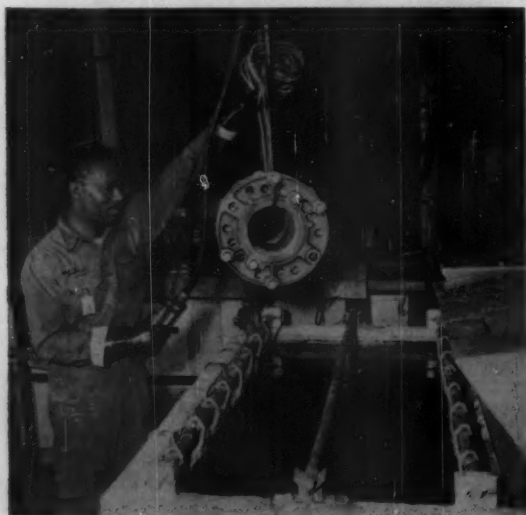
Lycoming Division has successfully used alkaline descaling cleaners for several years. Typical production applications for these types of cleaners are:

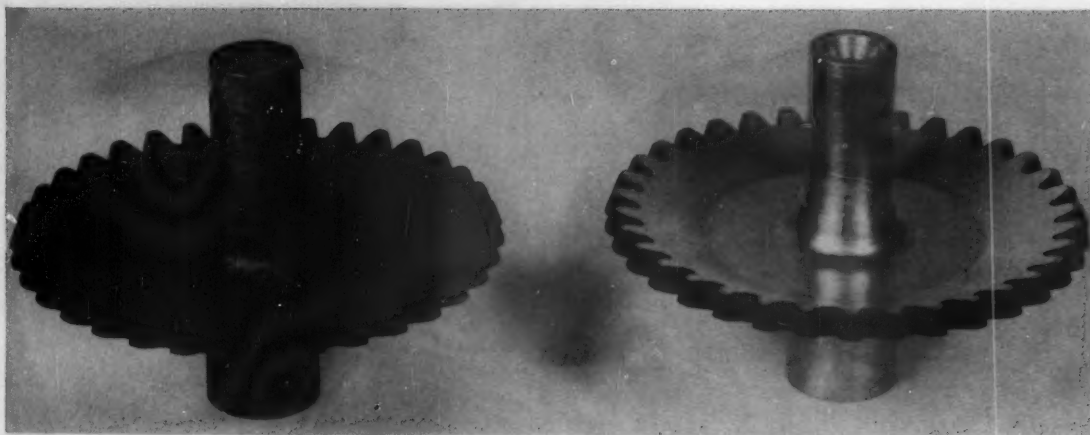
1. Removing heat treat scale from sheet metal ferrous alloy parts other than stainless steel, when abrasive blasting is objectionable or not feasible.
2. Removing carbon smut from partially copper-plated ferrous alloy parts that are carburized.
3. Removing oxides and quench press marks from copper plated ferrous alloy parts that are hardened.
4. Removing smut from parts that are stripped of copper plate.
5. Cleaning parts prior to plating.
6. Removing rust from machined parts.

Equipment

An unlined steel tank, 3' x 6' x 3' deep containing 360 gallons of solution is used at Lycoming. In some instances, a lined tank is recommended in order to eliminate possible bipolar effects, which would ultimately attack an unlined tank. Lead lined or wood tanks should not be used. Steel anodes can be used; however, with some types of solutions, best results are obtained with carbon anodes. The anodes should be cleaned on a weekly basis in order to remove a non-conductive film which forms during use. Copper, nickel, or lead anodes are not satisfactory, because they are attacked by the solution. An exhaust hood is provided on the tank to remove hydrogen and oxygen gas liberated at the anodes and cathodes during operation.

A reactronic type selenium rectifier, rated for 2 to 12 volts at 200 to 2,000 amperes direct current with





constant voltage control within plus or minus 2 per cent, is used to supply current to the tank. The 2,000 ampere output is split into three equally rated isolated outputs, and a specially designed magnetic amplifier control circuit balances the current within three per cent between three 1,000 ampere periodic reversing units. Utilizing this type of circuit eliminates the need of separating the anode and cathode bars into cells of 1,000 amperes each. A reactronic type rectifier was chosen because the sizes of the work loads will vary in surface area. The rectifier automatically compensates for the smaller work load, eliminating the possibility of arc burns between the parts and the rack.

A thermostatically controlled steam coil maintains the temperature of the solution at $130^{\circ} \pm 5^{\circ} \text{ F}$.

Solutions

Alkaline descaling solutions are usually composed of a chelating agent, sodium hydroxide, and a wetting agent. Proprietary compounds are available from metal finishing supply companies. For some applications, it is advantageous to add sodium cyanide to the bath, especially if smut is to be removed from the basis metal. Formulations are available with cyanide, or else cyanide can be added to the bath separately. The suppliers' recommendations should be followed closely when making up a new bath or making additions. The bath is controlled by a simple titration.

Lycoming is using a bath composed of two pounds of descaling cleaner plus one pound of sodium cyanide per gallon of water. This combination will satisfactorily remove heat treat scale, carbon soot, smut, and rust from ferrous alloy parts. The solution may be operated at room temperature, but it will be more effective at 130° F . If sodium cyanide is used in the bath, do not exceed 130° , because the cyanide will decompose rapidly. Without cyanide, baths may be operated in many formulations close to the boiling point. This is especially effective in paint stripping operations.

Racking

Racks made of steel are satisfactory for use with lower current densities. Racks made of copper, brass, aluminum, or nickel should not be used because they will be attacked by the descaling solution. If current densities of 75 amp./ft.² or higher are required, then

it is advisable to make the spine portion of the rack from copper, which must be insulated with a plastisol coating to prevent attack upon it by the solution. Iron is not satisfactory with higher current densities because it is a poor conductor of current. If the cross-sectional area is not large enough to carry the current it will become red hot. The work contact portions of the rack must be made of steel.

Racks for sheet metal parts should be designed with pressure clamp type contacts. The contact to the work should cover enough area to prevent arc burns. This occurs primarily due to the inability of the thin sections of the part to distribute the current to other areas without becoming red hot.

If the parts are covered with heavy rust or scale, then it is advisable to abrade the area where the contact is made. Otherwise, sufficient current may not pass from the rack to the part.

Spacing of the parts on the rack and in the tank is similar to that employed in plating.

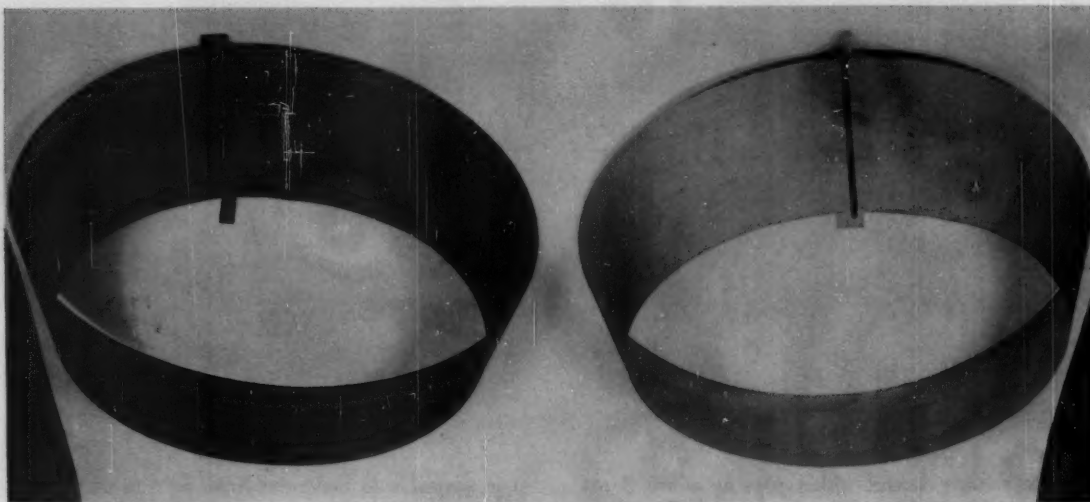
Cleaning Carburized and Hardened Parts

Carburization of steel takes place when the steel is heated to a high temperature, while in contact with a carbonaceous material, which may be a gas, liquid, or solid. At the high temperature, there will be an inward diffusion of the carbon into the surface of the steel. The carbon-enriched surface layer of the steel is often termed the case, and the entire process is termed case hardening. The carbon will cause the surface of the steel to be substantially harder than the interior.

It is often desirable that only specific areas be carburized, such as gear teeth or shaft splines. In this case, it is necessary to copper plate the areas not to be carburized. A plate thickness of 0.0007 to 0.001 inch is usually satisfactory. The copper plate must be free of pin holes or porosity, which would permit hard spots. These hard spots would be objectionable if further machining is required on areas not carburized, because a cutting tool is liable to break if it hits the hard spot.

Usually the copper is plated all over the part and then ground off areas to be carburized. For some applications, rubber masks can be used. A recently developed stop-off compound which proved quite successful for use in cyanide copper, is currently being used to mask areas not to be copper plated.

When the parts are in the carburizing furnace, they



become covered with a tenaciously adhering carbon soot. This soot must be removed from the plated parts before they can be stripped of copper, which was formerly done by abrasive blasting each part. This was an expensive time consuming process, because each part had to be handled individually. An investigation into new methods for removing the carbon soot disclosed that a descaling type cleaner would satisfactorily remove the soot. The parts are placed on racks, vapor degreased, and then cleaned in the descaling cleaner, using a periodic reverse cycle of 10 seconds anodic and 10 seconds cathodic with a current density of 75 to 150 amp./ft.² A tank load of parts can be satisfactorily cleaned in 10 minutes. Some of the copper will be electrolytically stripped, because the bath contains cyanide. The plated parts are then rinsed and placed in the copper strip tanks. Areas such as deep recesses and I.D. holes are not satisfactorily cleaned because of low current densities.

When the parts are removed from the strip tanks, they are covered with a black smut. This smut must be removed prior to copper plating the parts. The copper will prevent decarburization during hardening. This smut was also formerly removed by abrasive blasting. Now the parts are rinsed after stripping and placed into the descaling cleaner. The same periodic reverse cycle and current density are used as for removing carbon soot. The parts are cleaned for 10 minutes, rinsed, dipped into 15% by volume of muriatic acid, rinsed, and cyanide copper plated to a thickness of 0.0003 to 0.0005 inch.

The copper plate prevents decarburization of steel, when the parts are subjected to the high temperatures of a hardening furnace. If the parts were not copper plated, then the carbon would diffuse to the surface of the steel where it would combine with available oxygen in the furnace atmosphere. The carbon will also combine with hydrogen and water vapors.

When the parts are removed from the hardening furnace, they are usually quenched in oil. Often a quench press is used to prevent excessive distortion of the part. The copper plate becomes oxidized and has a thin layer of burnt oil on the surface. This surface layer of ox-

dized copper and burnt oil must be removed prior to stripping. This was also formerly done by abrasive blasting. The descaling cleaner is now used. The same current densities and periodic reverse cycle, as for removing carbon soot, are satisfactory; however, twenty minutes are required to clean a load. After stripping, the parts are again cleaned in the descaling cleaner to remove smut. They are then subjected to a freezing operation to convert retained austenite and finally tempered.

The company has realized a \$20,000 a year savings, in time, by the substitution of the descaling cleaner in place of abrasive blast operations in the processing of carburized parts.

Removing Rust and Scale

Concentrations from one to three pounds of descaling cleaner per gallon of water are used for rust and scale removal. Cyanide added to the bath, at a concentration of one pound per gallon, may accelerate the removal of some types of heat-treat scale. Temperature of the solution may be from room to boiling in some formulations. Rust and scale are more rapidly removed at the higher temperatures.

Prior to derusting or descaling, any oil or grease should be removed from the parts. Descaling cleaners are not formulated to remove oils, especially if they are operated at room temperatures. Oil will shorten the life of some baths considerably. Parts should be pre-cleaned in either a vapor degreaser, alkaline cleaner, or emulsion cleaner.

Light rust can be removed in a minute or two by making the part cathodic. Heavy rust or heat-treat scale is rapidly removed by using periodic reverse current. A periodic reverse cycle of 10 seconds anodic and 10 seconds cathodic is satisfactory. Shorter cycles may be used to an advantage in automatic equipment when time is a factor. Current densities from 5 to 150 amp./ft.² are used. Higher current densities are generally used when heat-treat scale is to be removed.

Heavy rust or heat-treat scale may require up to 45 minutes for successful removal. At times, it is advan-

(Continued on page 55)

The Sulphur Dioxide Test

By J. Edwards, *The British Non-Ferrous Metals Research Association*

This article is based on a paper presented at the Institute of Metal Finishing [Trans. Inst. Met. Fin., 35, 55 (1958)]. Acknowledgement is made to the Institute for permission to reproduce some of the illustrations and tabular matter from that paper.

IN order to estimate the corrosion resistance of chromium-plated articles in a shorter time than would be required for atmospheric exposure tests, various accelerated corrosion tests are used. In a number of these, the main corrosive agent is sulphur dioxide. This gas is known to be an important constituent of industrial atmospheres, and it is reasonable that attempts should be made to employ it in accelerated tests, achieving the required degree of acceleration by control of concentration, humidity, temperature, etc.

One such test was developed at the Chemical Research Laboratory, primarily for the study of paint films,¹ although the test has been used also to examine the protection provided by metallic coatings. The samples are suspended over a warmed solution of sulphur dioxide in a large beaker. A cooling coil surrounding the vessel at the level of the specimens causes moisture to condense on them. Further small quantities of sulphur dioxide solution are added daily for as long as the test continues.

In the Kesternich test,² developed in Germany and employed largely in the testing of anodic films on aluminum, a similar principle is followed in that the specimens are supported above a solution reservoir which is heated to a temperature considerably above the ambient. The test cabinet, which is relatively large, is not heat-insulated and the specimens, therefore, are at a lower temperature than the solution, so that heavy condensation takes place on them. The test atmosphere contains carbon dioxide as well as sulphur dioxide. In the recommended method of operation, these conditions are maintained for 8 hours out of every 24; during the remaining 16 hours the specimens are allowed to stand at room temperature exposed to the normal laboratory atmosphere, although retaining the condensate formed during the first period. This cycle may be repeated as often as desired.

The main drawback of both these tests is that the continuous condensation causes a flow of solution to

occur over the surface of articles undergoing test, obscuring and possibly modifying the pattern of attack. This difficulty is not met when samples are simply suspended at room temperature in a closed vessel containing a solution of sulphur dioxide; yet, under these conditions, the rate of attack is quite high enough for most purposes. A test of this kind has been employed for many years at the *Tin Research Institute* for assessing the protective value of tin alloy coatings.³ When, at the *British Non-Ferrous Metals Research Association*, a search was being made for suitable accelerated corrosion tests for nickel + chromium and similar coatings on steel, preliminary trials of this method showed that it possessed the advantage that moisture collected on the surface of the specimens only at the points where corrosion was occurring. Attack was rapid but, unless the test was continued for a long time, it was rare for any flow of corrosion product to take place. The pattern of attack, therefore, was clearly defined at the end of the test. Furthermore, these trials showed that many

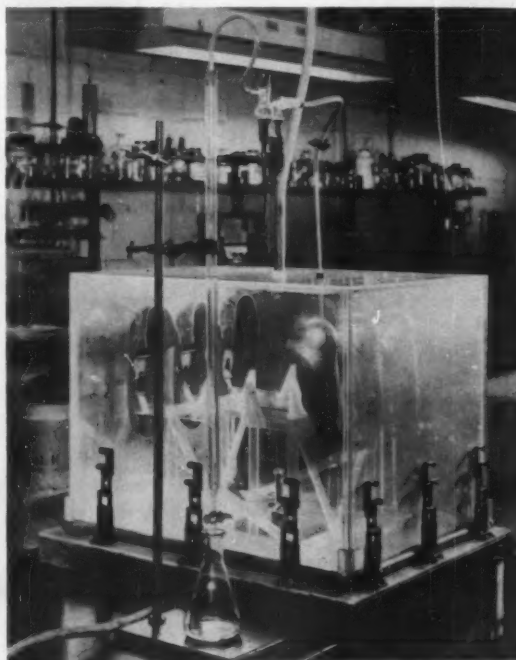


Fig. 1. View of Sulphur Dioxide Test Cabinet

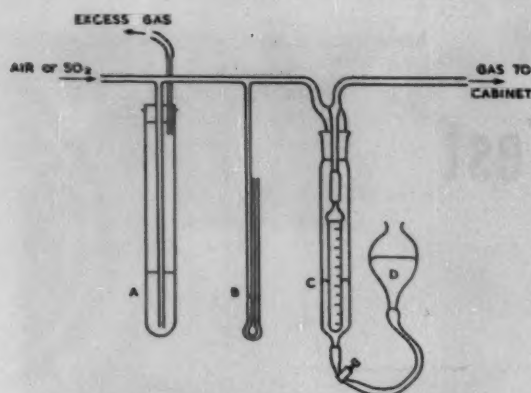


Fig. 2. Apparatus for Controlling Rate of Gas Flow.

of the modes of failure observed on plated articles during outdoor exposure could be reproduced in this test, e.g. corrosion pitting, cracking of the nickel and of the chromium, etc.

Therefore, it was decided to examine a test of this kind in some detail, in order to assess its suitability for research purposes and as a standard control and acceptance test for production articles. In particular, it was desired to investigate the relationship between exposure and accelerated test results, to determine the variations in test conditions which could be tolerated without undue effect on the nature and severity of attack, and to find suitable ways of maintaining the required conditions, especially in large cabinets.

Apparatus and Procedure

The tests made in the Association's laboratory employed the equipment shown in Fig. 1. The cabinet consists of a Perspex (Lucite) base on an iron covered inverted Perspex box of dimensions 2' x 1½' x 1½'. The cover is held down by 12 spring clips, a rubber seal ensuring gas-tightness. A 2" high barrier just inside the seal allows the base to be covered with water. A Perspex fan, revolving at about 150 rev./min., is fitted a few inches above the base.

To ensure rigorous control of SO₂ concentration in the early tests, air and SO₂ were mixed in the required proportions and passed continuously through the cabinet. The rates of flow of the gases were separately controlled by flowmeters, each constructed as shown in Fig. 2. Gas pressure is kept constant by maintaining a slow stream of bubbles through the 10 cm. mercury head in A. The pressure is read on the manometer B, and the gas passes through the porous tube in C, the rate of flow being determined by the area of the tube exposed above the mercury.

In later work SO₂ was passed into the cabinet only for a few minutes at the beginning of each test; once the required concentration was reached, the flow was stopped and the inlet and outlet tubes of the cabinet closed. Further additions were made only if subsequent analysis indicated the need.

Analyses were made as follows:

The inlet of a 10 ml. absorption tube is connected to the cabinet and the outlet to the top of a 100 ml.

burette filled with water and used as an aspirator. 0.5 ml. N/10 iodine solution is placed in the tube, which is then filled up with distilled water. A drop of starch solution is added. Gas is then drawn from the cabinet through the absorption tube by allowing water to run out of the burette, and the volume required to decolorize the solution is read off. A simple calculation gives the concentration of sulphur dioxide in the test atmosphere.

The relative humidity in the cabinet is measured approximately by means of wet and dry bulb thermometers. Flooding the base of the cabinet was found to give a high relative humidity (0.1-0.5°C. difference between wet and dry bulb) without any further steps being necessary. The articles under test are supported on a Perspex stand. The cabinet is not temperature-controlled but is protected from rapid temperature variations.

At the end of a test, the solution is drained off and absorbed in sodium hydroxide solution, and the gas is removed by blowing it into a ventilation duct. The cover is removed, and the specimens are allowed to dry, exposed to the atmosphere. If they are not to be examined immediately, it is desirable to dry them thoroughly by gentle heating.

Preliminary Investigation of the Characteristics of the Test

EFFECT OF VARIATIONS IN SULPHUR DIOXIDE CONCENTRATION:

A large number of tests showed that variations in the sulphur dioxide concentration had little effect on the severity of corrosion. The two sets of copper + nickel + chromium-plated specimens shown in Fig. 3 indicate that the effect of variations within the range 0.5-3% by vol. is negligible.

The test atmosphere was maintained at approx. 1% SO₂ by volume in subsequent work.

Periodical gas analyses after stopping the flow through the cabinet showed that the greatest loss of SO₂ occurred by leakage. Loss by oxidation to sulphuric acid was small, but appreciable amounts were consumed by reaction with the test samples, the consumption increasing with the extent of corrosion.

The maximum loss of SO₂ from all causes in 24 hours was 50%. It is possible, therefore, to conduct 24 hour tests and, possibly, even longer tests, without adding further SO₂.

EFFECT OF VARIATIONS IN TEMPERATURE AND RELATIVE HUMIDITY:

No systematic investigation was undertaken of the effect of variations in temperature and relative humidity, all tests being carried out at ambient temperature. Relatively small variations in the severity of corrosion were observed at times, however, and usually seemed to be attributable to variations in relative humidity associated with temperature changes. Whenever relative humidity fell below 95%, there was a marked fall in the rate of attack. On the other hand, if copious condensation occurred on a specimen, on account of a sharp fall in temperature, spreading of the corrosion product took place, giving the appearance at

least of more extensive attack. Such departures from the normal conditions rarely occurred however, with the apparatus as described above.

DURATION OF TEST:

In the preliminary work, rather long test periods were employed (usually 96 hours) since it was easier to examine the effect of variations in test conditions and the correlation with outdoor exposure when corrosion was severe. In most cases, however, the pattern of attack was established within 24 hours and, unless the nickel deposit was of good quality and exceeded 0.001" in thickness, some penetration to the basis metal normally occurred within this period.

CORRELATION WITH OUTDOOR EXPOSURE:

Various coatings on steel, including Ni + Cr,

Cu + Ni + Cr, bronze + Cr, bronze + Ni + Cr, Cu + white brass + Cr, and Cu + tin-nickel, were tested for 96 hours and compared with similar samples exposed at industrial and marine sites and with others subjected to the acetic acid-salt spray test.

There was good agreement between the orders of protectiveness revealed by the SO₂ and atmospheric tests, and the kinds of breakdown were also similar, covering the range of pitting, cracking, general corrosion, and flaking. These types of failure were reproduced rather less well by the acetic acid-salt spray, partly because the salt and corrosion product obscured the details. Equally good correlation with exposure results was found in many other tests, mainly on nickel + chromium-plated steel.

Relatively little rust staining appeared in 24 hour tests on specimens having a copper or bronze under-

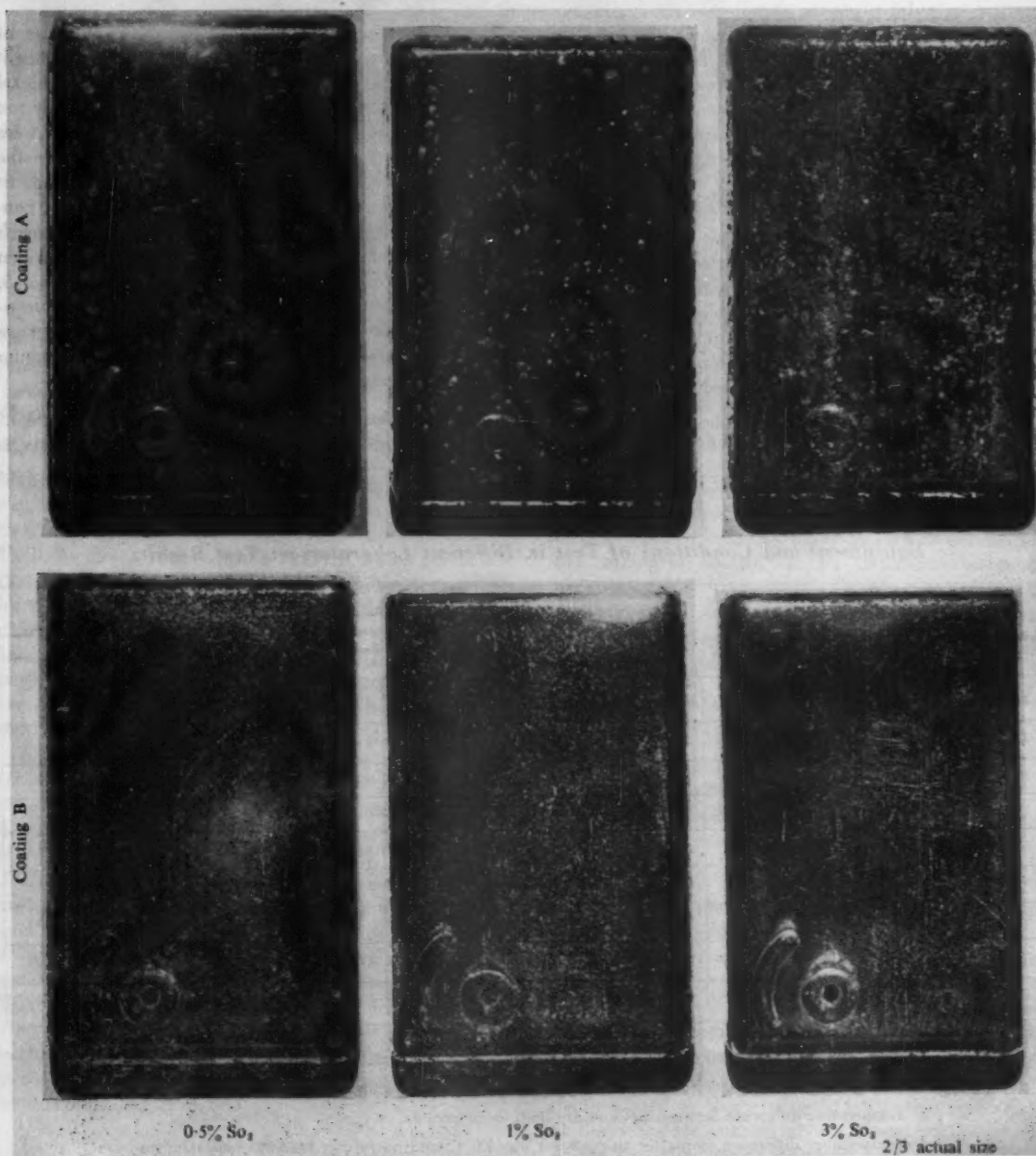


Fig. 3. Effect of variation in sulphur dioxide concentration in 96 hour test.

coat, indicating relatively slow penetration of these layers.

Reproducibility of Results in Different Test Cabinets

Nine members of the B.N.F.M.R.A., who had constructed equipment for SO₂ testing, co-operated in a program of tests on equivalent sets of plated articles — mostly nickel + chromium on steel, but some also with a copper undercoat, and a few plated brass articles. All the tests lasted 96 hours but the conditions and procedures employed varied widely.

Tests made at elevated temperature, under conditions such that continuous condensation occurred on the specimens, caused considerable spreading of the corrosion product, and did not place the specimens in the same order of durability as the others. Room temperature tests did place the samples in approximately the same order of durability and developed similar patterns of attack on specimens of each group. The severity of corrosion varied, however. The factor which appeared to have the greatest effect on the rate of corrosion was relative humidity. There were wide variations in SO₂ concentration (at least 0.5 to 5%) and in temperature, but they seemed to have little effect.

In a second series of tests, the specimens consisted of steel wheel discs, plated with Ni + Cr or Cu + Ni + Cr. All similar discs were plated in the same way. Each disc was cut into four sections, three of the quadrants being distributed for SO₂ tests and the fourth exposed at Euston (London). Each of the nine laboratories taking part tested ten specimens for 24 hours and nine for 96 hours.

All were asked to maintain an atmosphere contain-

ing approximately 1% SO₂ at a relative humidity just below 100%. Some important details of the equipments used and the actual conditions of test are tabulated in Table I.

After testing, the specimens were assembled as complete wheel discs. In general, agreement between SO₂-tested and exposure-tested samples was good in regard to the most prominent defects and the number and distribution of pits, cracks, etc. This comparison was first made when the exposure-tested samples had been on test for only 7 weeks (under foggy conditions, however, in a severe industrial atmosphere). A later comparison, after 9 months exposure, showed equally good correlation, the specimens having suffered greater attack, naturally, but without appreciable modification of the pattern of attack or of the order of durability.

Variations in the pattern of corrosion on parts of the same wheel disc in different cabinets were negligible, except where severe local attack of nickel occurred in areas where the chromium was locally too thin. Variations in the severity of corrosion were negligible on over 50% of the wheel discs, but some differences were observed on the remainder and, to test how far these were due to variations in test conditions, the extent of corrosion was assessed on each disc, the most severely corroded quadrant being given the rating 5 and the others the ratings 0 to 5, according to the extent of corrosion; in fact, however, only the ratings 3 to 5 were used. The average ratings, expressed as percentages of the maximum possible value, are tabulated in Table I.

Laboratories III, V and IX show a lower rate of attack but the agreement among the remaining six is

TABLE I
Equipment and Conditions of Test in Different Laboratories: Test Results

Laboratory	Capacity of Cabinet, liters	Area Water Exposed, dm ²	Heater	Fan	Method of Control of SO ₂ Conc.	Type of Flow-meter	Temp. Range, °C	Relative Humidity Range, % (°)	SO ₂ Conc. Range, % by Volume	Relative Severity of Corrosion, %		
										24 hours	96 hours	Mean
I	125	20	No	Yes	Continuous	Porous tube	19-23.5	0.1-0.2	1.1-1.2	98	96	97
II	550	35	Yes ⁽¹⁾	No	Discontinuous	Rotameter	23.5-29	0-0.2	approx. 1.0	96	91	94
III	300	34	No	No	Discontinuous	None	14.5-25.5	0-0.2 ⁽⁴⁾	0.9-1.7	70	100	84
IV	125	7	Yes ⁽²⁾	No	Discontinuous	Capillary	17-20	0-0.2	0.8-1.7	100	91	96
V	53	13.5	No	Yes	Discontinuous	Bubbling	11.5-16	0.5-0.8	0.9-1.2	76	80	78
VI	120	27	No	Yes	Continuous	Capillary	17-21	0.4-0.5	0.7-1.2	92	91	92
VII	53	13.5	No	No	Discontinuous	Bubbling	18.5-29	0-0.4	0.3-2.0	98	96	97
VIII	120	21	No	No	Discontinuous	Porous tube	18-19	0.4-0.6	0.7-1.3	96	89	93
IX	290	40	No	No	Continuous	Capillary	14-23	0-2.8	0.7-1.7	80	71	76

1. Heater in water, switched on when required during day (not overnight).
2. Heater in beaker of water (area 0.5 dm²) maintained 5°C. above room temperature.
3. Temperature difference between wet and dry bulb thermometers.
4. Temperature difference soon after start of test was 1.0°C. and no further reading was taken until the next morning, 16 hours later; this and subsequent readings were within the range shown.

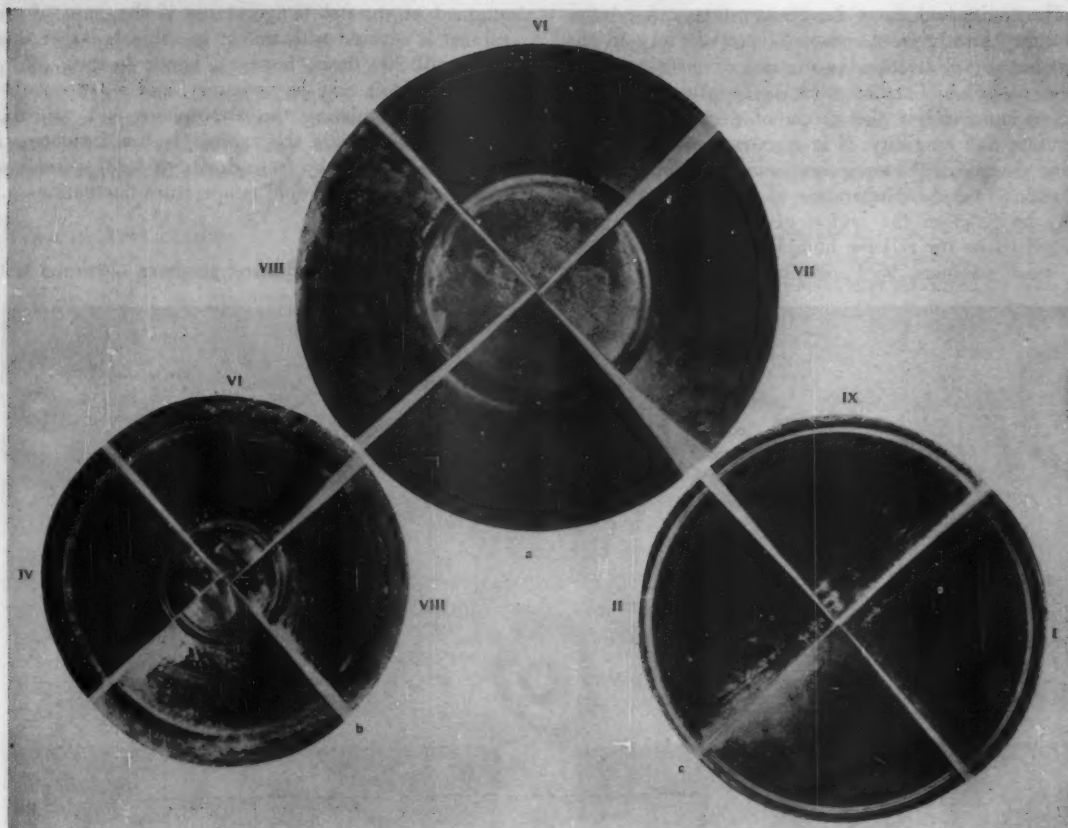


Fig. 4. Reproducibility of results in different laboratories. 24 hour test. Roman numerals indicate the testing laboratory. Bottom sector of each disc exposed for 7 weeks at Euston (cleaned after 6 weeks).

highly satisfactory. In the former group, tests were carried out at relatively low temperatures and humidities. Relative humidity in V was low throughout, in IX it fluctuated widely, while in III it seems probable that the high humidity reached late in the tests may have been slowly attained — this would explain the difference between the 24 hour and 96 hour tests. Low temperature and, in the case of III and IX, the large size of the cabinets probably contributed to the low relative humidities; in large cabinets it seems that gentle heating of the reservoir is desirable.

The results in Table I indicate that, within the range studied, temperature variations (unless they affect relative humidity) and variations in sulphur dioxide concentration do not greatly alter the rate of corrosion.

The photographs in Fig. 4 of reassembled wheel discs give some indication of the degree of reproducibility between laboratories and of the extent to which the pattern of corrosion developed in the test resembles that produced by outdoor exposure. Microscopic examination of sections of some of these discs showed that the corrosion pits in coatings tested in the SO_2 cabinet were very similar to those in coatings exposed to an industrial atmosphere under severe conditions (Fig. 5).

Conclusions

The SO_2 accelerated corrosion test seems suitable for use in production control, acceptance testing, and

research and development work. It is rapid and simple to use, and seems to reveal most of the weaknesses of electroplated coatings likely to lead to service failure. Stringent control of test conditions seems unnecessary, and reproducible results, therefore, are fairly easy to achieve. The basic requirements are summarized below, with some comments on the range of application of the test and the interpretation of results.

TEST CONDITIONS:

Recommended test conditions are:

SO_2 concentration — approx. 1% by vol. (0.5-2%)

relative humidity — over 95% (but avoiding general condensation)

temperature — ambient (i.e. 17-25°C.)

Sulphur dioxide can be introduced into the cabinet by any convenient means — as gas, as solution, or by reaction of bisulphite and acid inside the apparatus. Passing in SO_2 at the beginning of a test, and adding more later only if analysis indicates the need, seems perfectly satisfactory, although, in larger installations and for longer tests, it may be more convenient to pass a mixture of SO_2 and air through the cabinet continuously or to circulate SO_2 solution maintained at the necessary concentration. Determination of SO_2 in the test atmosphere is easily done by the method described above, involving aspiration through a standard starch-iodine solution.

The limits laid down for temperature and relative humidity have proved reasonably satisfactory in the past but some variations in the rate of corrosion have been observed. Further work is in progress to examine more closely the effects of variations in temperature and humidity. If it appears feasible, thermostatic control of the equipment may be recommended, in which case the temperature of operation will probably be fixed in the region of 25°C., and the permitted limits for relative humidity may be narrowed. In small cabinets, 95% relative humidity is readily

attained at normal temperatures if the base of the cabinet is covered with water; in cabinets larger than about 150-200 liters, however, gentle heating of the water reservoir may be necessary, and a fan or other means of circulating the atmosphere will probably be desirable. Unless the cabinet is heat-insulated, it should be sited away from drafts or local sources of heat likely to cause rapid temperature fluctuations.

PERIOD OF TEST:

For control or acceptance purposes, 24 hour tests



Fig. 5. Sections through pits produced by 24 hour and 96 hour sulphur dioxide tests and by 6 weeks exposure to an industrial atmosphere. a, b and c cut from one type of wheel disc and d, e and f from another.

are adequate. Any considerable departure from specified thicknesses, etc., as well as cracks and other discontinuities, are readily shown up within this period. Little basis metal corrosion occurs in a test of this duration on articles acceptable for outdoor service, however, and in any work concerned with improving durability longer times of test should be used.

RANGE OF APPLICATION:

The test is particularly useful for coatings on steel, including nickel + chromium, with and without copper or bronze undercoats, bronze + chromium with no nickel, tin and tin-nickel. Care must be taken in interpreting the results of short-term tests on coatings with and without copper undercoats, since the undercoat seems to delay initial penetration to the basis metal. Sulphur dioxide testing is applicable to other coatings on steel, such as zinc or cadmium, as an indication of protective value; further trials are required, however. The test will reveal weaknesses in nickel + chromium coatings on brass, and copper + nickel + chromium coatings on zinc alloy die-castings. In neither case, however, are the sites of corrosion very clearly marked and, on zinc alloy, probably because of the rapidity of the test and the solubility of the corrosion product, the coating is not raised in the form of blisters. As is well known, tests of this kind provide a very effective means of checking the adequacy of sealing of anodic films on aluminum.

INTERPRETATION OF TEST RESULTS:

So far as possible, it is essential to identify the par-

ticular defects revealed by SO_2 tests; assessment based merely on the bulk of corrosion product can be misleading. For example, cracks in the top coat of chromium show up very boldly, although in service they may not be very disfiguring even after long periods of time. There is no evidence, however, that the test reveals or develops cracks which would not at some stage become apparent under service conditions.⁴

The test readily reveals cracks or holes ("gross pores") in the plating. It also develops a pattern of pitting corrosion, similar to that produced by a service environment, which depends largely on the thicknesses of the deposits constituting the coating. Incomplete coverage by chromium (or extremely thin chromium deposits) are revealed, as well as cracks in the chromium.

There are obvious difficulties in laying down definite criteria for the acceptance or rejection of plated articles, in terms of their performance in the sulphur dioxide test. More and more industrial organizations are beginning to use the test, however, and it is hoped that it will be possible, when more experience has been gained, for all sides of the industry to agree on the maximum extent of corrosion permissible in a test of given duration, on articles intended for particular conditions of service.

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APPLICATIONS FOR ALKALINE DESCALING CLEANERS

(Continued from page 48)

tageous to use a 50% muriatic acid pickle in the descaling line, especially if the part has deep recessed or shielded areas such as encountered in sheet metal weldments. Pickle for three minutes, rinse, periodic reverse clean for five minutes, and repeat this cycle until all scale or rust is removed. Following descaling or derusting, the parts should be rinsed and dipped into a slushing oil or other rust preventative.

Descaling Cleaner in Cleaning Cycles

A descaling cleaner may be used to augment a cleaning cycle, replace an alkali cleaner or an acid pickle. For removing scale, rust, buffing compounds, and other stubborn soils, a descaling cleaner may be used to advantage in a cleaning cycle prior to electroplating.

These soils are removed rapidly in the cleaner, thereby shortening the overall time required to clean the parts. Some types of ferrous alloys, which have a tendency to form a smut during acid pickling, can be cleaned successfully in the descaling cleaner. The pickle may be eliminated. Following the descaling cleaner, the parts should be thoroughly rinsed and placed in the plating tank. If a vapor degreaser is available to remove grease and oils, then the hot alkali soak or electrolytic cleaner may be omitted.

Conclusion

Concentrations, temperature, and current densities for a particular application can only be determined successfully by experimentation. The time required to clean a part depends upon the amount of rust or scale to be removed. The time is usually shortened by increasing the concentration, temperatures, and current density.

Science for the Coatings Technologist

Part XI. Paint Additives: Driers and Anti-Skinning Agents

By E. S. Beck

(Continued from September issue)

We will next look into the properties of the various individual metals which are used as driers. Although each metal has its own individual characteristics and its own most useful applications, it must be emphasized that driers generally work best in combinations. They may be considered as synergistic materials. In fact, certain materials, especially zinc, which have no true drying properties in their own right, nonetheless form strongly-drying mixtures with cobalt or manganese. These synergistic properties will be considered under the various individual metals, in the appropriate places.

Cobalt

COBALT is beyond doubt the strongest and most universally effective of the drier metals. It is a strong purplish color in solution, and produces an easily-identifiable color when it is present in clear varnishes. It stains slightly in whites, but this is not generally objectionable, unless very large quantities are used.

Because of its great power, cobalt is used in extremely small quantities. For air-drying purposes, the commonly-used range is from one-hundredth to one-tenth of a percent. Drier amounts are expressed in terms of metal content. The percentages are based either on the oil content of the vehicle solids, as with varnishes, or the total vehicle solids, as with alkyd resins.

Even in these extremely small amounts, the cobalt produces very marked effects. It is essentially an oxidation-promoting catalyst. For that reason, it is well to use a polymerization-promoting catalyst along with the cobalt. Lead is a good example. Calcium also works well with cobalt, even though calcium is not a drying metal in its own right.

Cobalt tends to promote drying at the top of the film, where it is most in contact with the air. It can, if used injudiciously, cause hard skinning-over on the top of the film, to the detriment of the "dry-through." It is often called a "top-drier" for this reason. In extreme cases, it can cause wrinkling by this process of excessive top-drying. For this reason, a "drier" like zinc, which "holds the film open" for a while, is useful with cobalt. Zinc permits the film to dry through more thoroughly before the cobalt dries the top surface. Calcium has a similar function with cobalt.

Of course, there are cases where this wrinkling action is desirable. Cobalt is used in very large amounts in wrinkle finishes, to produce this very effect. Manganese can also do this, but usually straight cobalt, or a mixture of cobalt and manganese is used with wrinkle liquids. The appearance of this type of wrinkling would be most undesirable in the majority of applications,

therefore care in balancing the cobalt drier with appropriate modifiers is essential.

Cobalt is used almost exclusively as a drier for air-drying applications. In baked finishes it frequently causes too much discoloration. For air-dry uses, it is advisable to use a "through-drying" type of drier, such as lead in addition to the cobalt, even if either zinc or calcium are present as synergists. A combination of cobalt, lead and calcium is very valuable.

Cobalt is essentially an oxidation catalyst. This is another reason for the desirability of some lead (a polymerization catalyst) as well. A balance of oxidation and polymerization is to be obtained wherever possible.

Of all the drier metals, cobalt is the most valuable, the most active, and the most widely-used. The principal precaution to be taken in its use is to avoid the introduction of excessive amounts. Too much cobalt can produce surface wrinkling or premature failure outdoors.

Lead

Lead is the principal "through-drier" or polymerization catalyst. It is seldom used alone and is most valuable in conjunction with top driers, such as cobalt or manganese. It is generally used in amounts ranging from 0.1% to 1.0% of vehicle solids (for air-dry materials).

It forms many insoluble compounds with the fatty acids and other materials frequently present in resin. These precipitate, forming cloud, haze or actual sludge. Drier precipitation is almost always due to insoluble lead soaps. These can be controlled by using low lead contents or by incorporating a stabilizing material such as calcium.

Lead in itself is a rather slow catalyst, even though it is the oldest in use of all the drying metals. It is beneficial to the film in that lead soaps increase the flexibility and the durability of the coating.

Lead driers possess two minor disadvantages for some applications. First, lead is a toxic material. Although the amount used as a drier is very small, some manufacturers prefer to omit it altogether in products where freedom from toxicity is important. This includes paints to be used on toys, cribs, or other places where children might put the coated surface in their mouths.

The other drawback is the fact that lead stains in a sulfide atmosphere. While lead drier is non-staining and light in color in normal applications, it often discolors when sulfur compounds are present in the air or the film. This is because lead forms a black sulfide.

In light colors, this discoloration is noticeable. Calcium or zinc should be substituted here as the auxiliary metal.

Manganese

Manganese is a very active drying metal, resembling cobalt to some extent in its properties. It is not as active as cobalt, but is much more so than lead. It is used in quite small quantities, on the order of 0.01% to 0.1% (as with cobalt).

It, too, is a top-drier, and promotes oxidation. It seems to promote polymerization as well, to a more substantial degree than does cobalt. It is rarely used alone in air-dry finishes; but is frequently used as the sole drier in baking coatings. Here it is used in extremely small amounts, to avoid wrinkling or discoloration.

Manganese drier can also be used in wrinkle finishes to promote uniform heavy wrinkling. It is frequently used in combination with cobalt for this purpose.

Occasionally, both cobalt and manganese are used together in an air-drying formulation. In these cases, the manganese content is often held at one-half that of the cobalt.

Lead or calcium is usually included with manganese in drier combinations. This is necessary to get the best through-drying. Manganese is reputed to form more brittle, less durable films than does cobalt. Another drawback is the staining properties of manganese. It tends to form brown or black discoloration in the dried film. Care must therefore be used in the dosage of manganese, especially in light or white films.

An advantage for manganese is that it promotes skinning in the package to a much lesser degree than does cobalt. Where skinning is a problem, the use of manganese or cobalt-manganese combination is frequently indicated.

Calcium

Calcium is one of the newer metals used as drying catalysts, but its importance is increasing as more is learned of its valuable properties. It has little or no drying properties in its own right, but is very valuable as an auxiliary drier.

With cobalt or manganese, for instance, it promotes through-drying in a manner similar to lead. In some circumstances it is superior to lead. It is frequently used to replace lead where that metal cannot be employed because of toxicity, staining, or insolubility.

Calcium is pale and non-staining in any vehicle. In octoate form, it is colorless. This means it can be used in whites or baking enamels without fear of discoloration.

An unusual property of calcium is its ability to solubilize or stabilize other driers, notably lead. For use as a stabilizing metal, amounts in the neighborhood of half the lead metal content are frequently used. The performance of calcium as a solubilizer is quite remarkable. While it will not work in all cases, it is valuable in the majority of cases of lead hazing. The difference in clarity between a hazing-type formulation with lead and the same type plus calcium is very great; the stabilized varnish will be clear and bright where the unstabilized one is turbid and opaque.

With manganese, calcium is frequently used as a baking drier. It is not used by itself for this purpose, but only as an auxiliary drier with a more active metal.

Iron

Iron driers are very dark in color. This limits their use to dark-colored finishes, as the staining power of iron drier is very great. Iron is not very effective for air-dry coatings, and finds its chief use in baking enamels. The one air-dry use for which iron is valuable is in the case of fish oils, where the use of iron drier reduces tackiness.

Iron is essentially a polymerization catalyst, which makes it of additional value as a baking drier. Where used as a baking drier, it generally is used alone, in amounts in the range of 0.1% to 0.3%.

Zirconium

Zirconium is one of the newest of the drier metals. It is not widely used as yet, but its properties are such that for certain end-uses, it is quite valuable, so it would seem just a matter of time until it becomes an important drier metal.

Zirconium has been inspected for possible value as a drier metal a number of times, and has been passed over each time because of limited activity. Actually, zirconium is another metal which has no drying properties in itself.

It is very synergistic with cobalt and/or manganese. Where it is used to replace the lead, some cobalt or manganese must be present as well. Zirconium should be used in the absence of lead to obtain best results. Originally, it was recommended as a partial replacement for cobalt or manganese. But it was found that if the lead were eliminated, and cobalt or manganese retained, the addition of zirconium gave many benefits.

The principal improvement lies in greatly increased hardness. This is achieved with no tendency to embrittlement. An additional advantage is better "through-dry." Drier absorption is reduced markedly. The matter of drier absorption will be discussed a little further on.

Another advantage of zirconium drier is its wetting or leveling effect on many films. It frequently produces films of higher gloss and greater smoothness. In roller-coat finishes, the ridges tend to level out more smoothly; in flow-coat enamels there is less pull-away from sharp corners.

When the zirconium is used to replace lead drier, there is the advantage of better color and package stability as well as absence of toxicity. Where a formula originally contained lead plus a top drier, the lead can be replaced by one-tenth to two-tenths the amount of zirconium. The quantity of zirconium should approximately equal the total amount of top-drier, as a rough rule of thumb. Thus, if cobalt were present, at 0.02%, the same amount of zirconium would be used.

Cerium or Rare Earths

These are additional new metals for drier use. They are enough alike in properties to warrant consideration together. Rare earth drier is approximately half cerium and half lanthanum. Its properties are somewhat better than those of the pure cerium, but of the same general order.

The rare earth driers are especially valuable for baking use. They are good polymerization catalysts, and seem to work especially well in epoxy systems. While they can be used alone, they show very good properties when used in conjunction with top drier, especially cobalt.

They are excellent in color, and produce no discoloration on baking, even in white finishes. The films produced are superior in toughness and hardness, sometimes to the extent that some of the urea or melamine hardener can be reduced.

Films containing rare earth driers frequently show improved resistance properties, undoubtedly owing to the better cure. In air-dry application, their value is less marked. In fact, it is not often that rare earth driers make important contributions here. But in forced-dry finishes, they frequently are of great value.

The amounts used are generally in the nature of 0.02% to 0.2% depending on the application, with most baking requirements falling in the range of 0.02% to 0.04%.

Zinc

Zinc is another auxiliary drier. Its greatest popularity was during the time that rare earth, calcium and zirconium were still under development. It is without any drying action of its own and, used with a top-drying metal, such as cobalt or manganese, it can result in harder films being formed than if it were absent.

This is because of its unique action of actually impeding the solidification of the film. Thus it keeps the upper portion open longer, so that the whole film can dry through to a greater extent before the air interface of the film skins over. While zinc frequently slows down the initial dry point of films, in the majority of cases they dry to complete hardness in the same time.

Zinc soaps contribute to the hardness of films directly as well. Zinc oxide, frequently used to harden coatings, does so by virtue of the zinc soaps formed by reaction with the acids present in the vehicle. Of course, the amount of zinc added to the coating in the form of a zinc drier is small. Thus the direct hardening effect would be expected to be small as well. This effect is larger than would actually be expected because of the great solubility of zinc driers. The very good solubility contributes to increased reactivity, hence increased film hardening.

This solubility of zinc drier also extends to metals added with it. Zinc tends to increase the solubility of lead driers, and to reduce or eliminate lead hazing. It is also a good wetting and dispersing agent and, where included in the formula, is of most value when used in the pigment dispersion.

The amounts of zinc drier used in a given case will depend upon the purpose for which it was incorporated. As an auxiliary drier, amounts generally run in the vicinity of 0.1% to 0.2%. But as a dispersing agent, up to 1% or even higher is not uncommon. Zinc is a drier material which, like calcium, can be used in almost any reasonable amount with no deleterious effects.

Solid Drier Materials

The driers we have discussed to this point have been

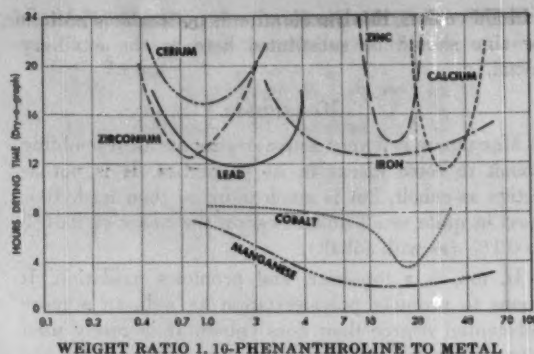


Figure 3. The Effect of 1,10-Phenanthroline on Various Metal Driers.

The action of 1,10-phenanthroline is different for each drier metal. In this study, the more widely used metals are shown. For purposes of comparison, they are all held at a metal concentration of 0.08% on resin solids. The data were determined on clear films of a soya alkyd resin. As the ratio of 1,10-phenanthroline to metal is increased, the activity goes through a maximum, and then falls off again. Optimum performance (exclusive of cost) is obtained at this point. Even the shape of the curve is different for each drier metal.

soluble liquids. There is a limited usage for certain of the metal soaps in solid form, such as linoleates, resinates, etc. These are used in the same amounts and for the same purposes as the soaps in solution. They are ground in, dissolved in hot thinner or varnish, or otherwise incorporated. They have no special advantages.

One solid material of importance is litharge, or yellow oxide of lead. This is frequently ground into formulations with the pigment. One or two percent of litharge will provide a strong positive dry, with reduced drier absorption. Where litharge is used, liquid top driers are generally used as well.

Aging Properties

There are two matters to be considered under this heading. First is the sweating-in or aging-in of driers. The properties of a drier combination can not be evaluated until the drier has been incorporated into the vehicle, and allowed to age for at least 24 hours. Some driers are more critical about this aging-in than others. But all show improved properties after the aging-in period.

A frequent source of trouble is the loss of drying shown by some products on prolonged aging. This has been found to occur briefly with certain pigments: carbon black, titanium dioxide, toluidine red, etc. This has been attributed to absorption by the pigment. The loss of drier by absorption is not an easy matter to overcome. Use of zirconium drier, without lead, is claimed to reduce drying loss markedly.

The traditional method of combating drier absorption is to add additional driers to the formulation at the time it is made. This has certain obvious drawbacks, such as encouraging wrinkling. Another approach is to grind a portion of the driers in with the pigment, on the assumption that the absorbing tendencies of the pigment can be satisfied immediately. The finished formula is then checked, and balanced, if necessary, for adequate dry.

A more elegant, and more satisfactory method than

the traditional ones outlined above, is the use of a drier compound which releases metal gradually throughout the life of the paint (in the liquid state). These are available both in cobalt and in lead form. In those formulations where cobalt and lead are used, the incorporation of a portion of these "feeder" type driers will distinctly prolong the package drying properties of the product.

1, 10-Phenanthroline

The use of 1, 10-phenanthroline will apparently eliminate drier absorption, even over a period of years. This compound is a most remarkable material. If it were not so expensive, it would be an indispensable component in many air-drying materials, and many baking enamels as well. As it is, the material must be used sparingly and efficiently and only where it is indispensable.

The 1, 10-phenanthroline does three things in a coating, when used in the correct quantities: it accelerates the drying rate, reduces or eliminates drier absorption, and restores drying ability to old paints.

With each individual drier metal, 1, 10-phenanthroline exhibits a characteristic performance. As the ratio of additive to drier is increased, the drying speed increases, then decreases, thus passing through an optimum. It is this optimum, or lowest point on the curve, which would normally indicate the amount of 1, 10-phenanthroline to use. However, because of the price, other quantities are often employed, with marked benefit.

In a mixture of driers, the amount of 1, 10-phenanthroline to be used is the sum of the optimum amounts for each drier. These optima vary not only with the individual drier, but also with the amount of that drier.

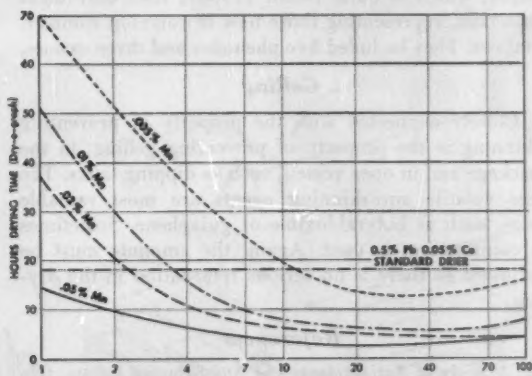


Figure 4. Drying Behavior of a Tall-Oil Alkyd.
(Courtesy of Federation of Paint and Varnish Production Clubs)

This illustrates the behavior of 1, 10-phenanthroline on a single drier metal, manganese, when the metal is present in various concentrations. The broken line across the chart is the drying time of a standard lead-cobalt mixture. It will be noticed that the general shape of all the curves is the same. To match the standard drying time of 18 hours, using 0.02% manganese, it is necessary to use only $2\frac{1}{2}$ times this amount of 1, 10-phenanthroline, or 0.05%. To accomplish the same action using 0.005% of manganese, one must go to 12 times this amount of 1, 10-phenanthroline, or 0.06%. With the 0.05% manganese level, the curve will intersect at a ratio of less than one, so that only about 0.03% of 1, 10-phenanthroline will be needed. In the case of a very expensive additive, such as 1, 10-phenanthroline, careful determination of the minimum amount necessary is essential to control costs.

For instance, in the case of 0.02% manganese, the optimum amount of 1, 10-phenanthroline is 13 to 1. Where the manganese content is 0.001% the optimum amount of the material is about 60 to 1.

Thus, a certain amount of study is beneficial before 1, 10-phenanthroline is used. By changing the type or amount of metallic drier, the demands for the 1, 10-phenanthroline may be reduced. In general, the additive works especially well with manganese and zirconium and rather inefficiently with calcium and zinc. Lead and cobalt are in an intermediate category.

This improvement in drying is prompt and vigorous. As pointed out above, the drying action becomes permanent, with very little loss of dry on aging. The catalytic effect of 1, 10-phenanthroline on drying is perhaps most striking when observed on old batches of paint which have lost their drying power through drier absorption or precipitation. In these cases, addition of extremely small amounts ($\frac{1}{2}$ to 1 lb. per 1000 gals.) will frequently restore the lost drying power.

Anti-Skinning Agents

These materials are anti-oxidants, and are properly known as such but, in common paint laboratory parlance, they are generally called anti-skinning agents. Their principal function is the prevention of skinning of paint in the package.

Skinning in the closed package can be prevented in a number of ways besides the use of anti-oxidants. In clears, especially, simple reduction of the solids (where practicable) will often serve to reduce or eliminate skinning in the package. Use of stronger solvents, slower solvents, and lower drier dosages all help. But often there is not time to test out all of these possibilities, or other considerations may prevent reduction in driers or change in solvents. And, all-too-often, when time is taken to adjust all these variables, there still remains a degree of skinning which cannot be overcome.

Certain specifications call for very severe skinning tests. Perhaps the strictest of all is the 72-hour open can skinning test. Here, the finish is continuously exposed to evaporation of solvent plus an unlimited oxygen atmosphere. It is just about impossible to build this sort of property into the paint without the use of an anti-skinning agent, and a powerful, non-volatile one to boot.

In general, the fuller the package, the less the skinning. This is because there is less air available to oxidize the oil in the paint. A great many standard skinning tests in specifications use a half-filled can as the standard. This introduces a substantial quantity of air and makes the test reasonably difficult. It is extremely hard to formulate a coating with any drying qualities which will not skin when there is only a half-inch or so left in the bottom of the can.

Theoretically, any material with a strong affinity for oxygen can be used as an anti-skinning agent. As a practical matter, however, the substance must be soluble in paint thinners, compatible, free of objectionable odor (some of the anti-skinning agents in use do have a bad odor but, compared with what organic chemistry is capable of, they must be placed in the mildly-odorous category) etc. Perhaps thirty-five or forty mate-

rials in all are used for this purpose, with the greatest usage concentrated on three or four types.

The Cleveland Paint and Varnish Production Club¹ listed thirty-five anti-skinning agents in a series of tests on durability of anti-skinning tests. It is of great interest to note that in their work, using four different vehicles, and testing both in Florida and an accelerated weathering machine, the anti-skinning agents in no case hurt the durability. In fact, in a great many cases, the durability was improved. Resorcinol and beta-naphthol improved the durability in all cases. This is a plus value from the use of anti-skinning agents, but is obtainable only from the permanent types, which do not leave the film. Unfortunately, the volatile types are the most practical for other reasons, as they leave the film promptly and do not delay the drying unduly.

The Montreal Paint and Varnish Production Club² divided anti-skinning agents into five categories:

1. Amino compounds
2. Phenolic compounds
3. Acidic compounds
4. Solvents
5. Commercial products of unknown composition

The Montreal Club goes a little far afield, since they consider solvents as anti-skinning agents by virtue of their dispersing power on gels which would otherwise clump and form a continuous film of 'skin.' Actually, the amino and the phenolic compounds comprise the group of widest usage.

The phenolics, such as guaiaphene, guaicol, resorcinol, alpha or beta naphthol, hydroquinone, eugenol, ortho-amyl phenol, etc., are the most powerful in their action. But they are rather odorous (even the trace amounts which are used are easily detectable as the film dries) and very non-volatile. This combination of powerful activity plus low volatility is dangerous. Most of the powerful anti-oxidants slow down drying very markedly. Unless they are sufficiently volatile to leave the film in a short time, they will continue to impede the drying of the film for a prolonged time. Some materials, such as hydroquinone or pyrocatechol, can cause the film to remain wet for five days or more if present in sufficient quantity.

It is customary to establish the exact amount of agent required to hold down the skinning with a minimum amount of loss of dry, and to use only this amount. But these items are used in such small quantities (0.1% of vehicle solids is typical for the phenolics) that the possibility of error cannot be overlooked. If even a small additional amount is added during production, the batch may refuse to dry. And it is no simple matter to overcome an over-add of antioxidant. I remember all-too-well an instance where the factory added guaiaphene in gallons to a large batch of paint calling for guaiaphene in fluid ounces. We could find no way to reduce the drying retardation except by expanding the batch

one hundred-fold in volume. Unfortunately, it was an item infrequently made, so this solution was not practical. Ultimately, the batch was used as an antiskinning agent (and shading material) for another coating of similar vehicle composition.

The so-called amino types of anti-skinning agents include the oximes, alpha and beta naphthylamine, guanidines, aniline derivatives, phenylene diamines, etc. Of these, the oximes are the most widely-used. In fact, the oximes represent the most popular of the paint anti-skinning agents. The other amino materials, while efficient, are too non-volatile for most applications. The oximes, on the other hand, are quite volatile and not overwhelmingly powerful. Butyraldoxime, for a while, was the only representative of the class in commercial use. It is quite powerful, and a little too slow in evaporating rate for comfort. Much trouble was experienced in its use unless great care to balance out the formula was used. With caution, good results could be obtained, and it enjoyed, and still enjoys, a substantial use. Other oximes, however, were later developed which were much more volatile, hence much safer to use. These, while less efficient than the butyraldoxime, still do a good job, and are free from the hazards of overdosage in that they have no marked effect on the drying.

The Philadelphia Paint and Varnish Production Club Anti-Skinning Agents Committee³ reports a large series of tests. From these, the first conclusion of interest is that the anti-skinning agents work quite differently in different vehicles. Thus, the material selected must be tested to be sure it will be satisfactory in the vehicle to be used. Secondly, when small amounts are used (one-sixteenth of one percent) the differences between the anti-skinning agents becomes very small.

It is also interesting to note that the Philadelphia paper, which is quite recent (1956), tests only eight materials, representing those now in common commercial use. They included five phenolics and three oximes.

Gelling

Closely connected with the property of preventing skinning is the property of preventing gelling, in the package and in open vessels, such as dipping tanks. The less volatile anti-skinning agents are most valuable here, such as butyraldoxime or guaiaphene. Sometimes a combination is used. Again, the amounts must be adjusted so there is no serious retardation in the drying.

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New Painting Facilities Effect Production Economies

By Bert Goldrath

INCORPORATING some of the most modern equipment and techniques known to the metal finishing industry, a new paint finishing department has increased efficiency and quality at Ampex Corp., Redwood City, Calif.

Double the size of the former facility, the new paint department has achieved a rate of productivity two to three times greater, according to Grover C. Hoskins, plant layout engineer. A smaller crew produces faster and better on one shift than a crew of 100 formerly turned out on three shifts.

Consistently high quality is obtained in a single series of operations, whereas a part previously might have had several re-runs through the cycle before it had an acceptable finish. Under the old system, some parts rejected for finish reasons would accumulate so much paint that they had to be stripped for a fresh start.

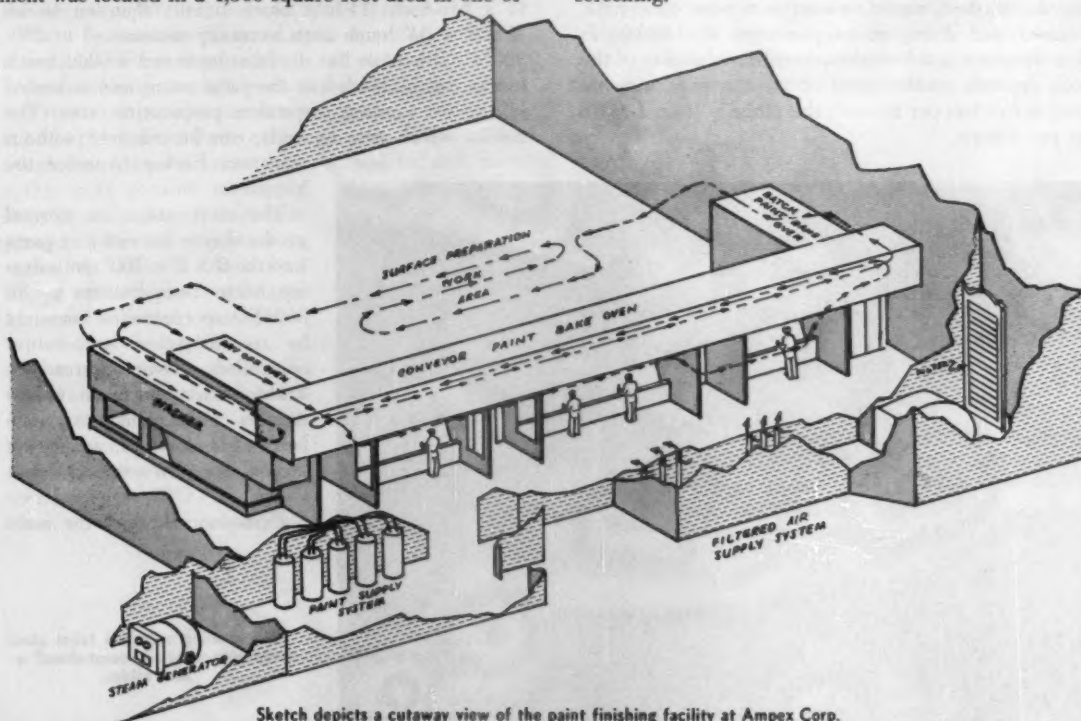
Ampex, a rapidly-growing company with 1,800 employees, manufactures precision magnetic tape recording equipment. Finish standards are high on the electronic components they produce. The standards are equally rigid for cabinet surfaces that are concealed.

The company was having difficulty in achieving desired finish quality with its old setup. The paint department was located in a 4,500 square foot area in one of

a series of scattered buildings. It was considered a bottleneck, since rising production volume could not be handled with original facilities. Then, there was the matter of obsolescence and the inefficiencies that show up in time in any production operation.

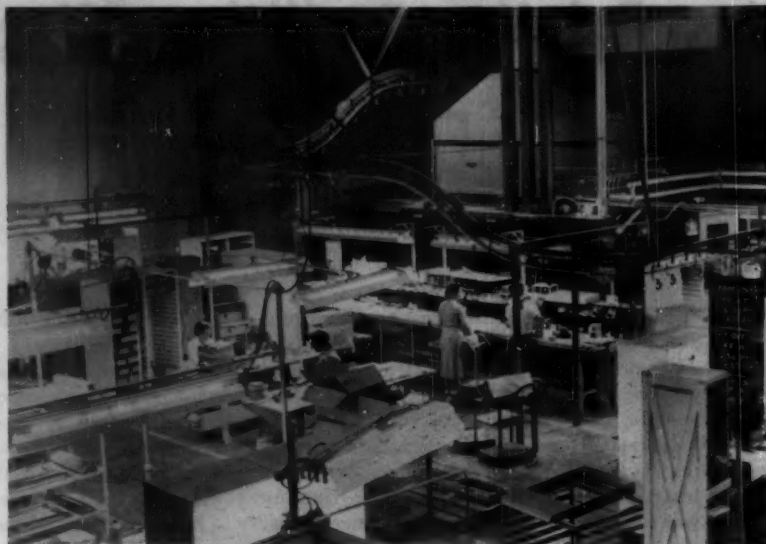
Now — at least for the foreseeable future — management feels that the ideal has been realized in a modern 9,000 square foot paint department in a new building. Some of the features of the installation are:

Five heated paint circulating systems feed up to seven paint spraying stations at one time, when peak loads are encountered. Work is 100 per cent conveyORIZED on a 600-foot variable speed overhead chain which can accommodate 600 items at a time. The paint room is hospital-clean and has a highly-filtered air system. Control over the painting and baking cycle can be obtained by the proper combination of oven temperature and baking time, both of which are adjustable over a wide range. Conversion of the power washer and various chemical tanks from gas to steam heat has improved regulation and reduced noise and dirt problems. Besides painting, the new department also provides space and facilities for wet and dry sanding, aluminum treatment, caustic dip treatment, and silk screening.



Sketch depicts a cutaway view of the paint finishing facility at Ampex Corp.

General view of the preparation area, with conveyor lines in background emerging from bake oven over paint room.



A high degree of flexibility has been engineered into the system, which may be termed a sort of expanded job shop method of production. The types of materials finished include aluminum die- and sand-castings, machine-turned and formed parts, welded assemblies, fabricated aluminum and steel parts. From one to 500 units comprise a run, with the average about 50 units. Sizes range between one-half by three-inch flat metal to 26" x 20" x 3" parts. Multi-

color and special parts which are to be masked are carried to the masking operation on the conveyor line, then through a batch painting booth on trucks.

A normal finishing cycle in its entirety comprises the consecutive steps of phosphate coating, dry off, cooling, primer coating, surface coating, baking, finish coating, baking, surface preparation, finish coating, baking, inspection, silk screening and wrapping.

Certain parts are diverted first into the plating and cleaning sections, which have seven 3' x 3' x 4' tanks. Here they may be pre-cleaned for welding, or subjected to a chemical film coating treatment.

A five-stage power washer is the first process for those parts that are hung on the conveyor line. Parts here are washed, rinsed, coated with zinc phosphate, re-rinsed and fixed, at temperatures of 140-190°F. Time duration in the washer, as in other phases of the cycle, depends on the speed of the conveyor. Normal speed is five feet per minute; the range is from 4 to 12 feet per minute.



After looping through the power washer, parts make a single pass through a drying oven, usually at 180 degrees for five minutes. To bring temperatures down to optimum spraying temperature of 130-135°F., the parts go through a ten minute cooling loop on the conveyor chain.

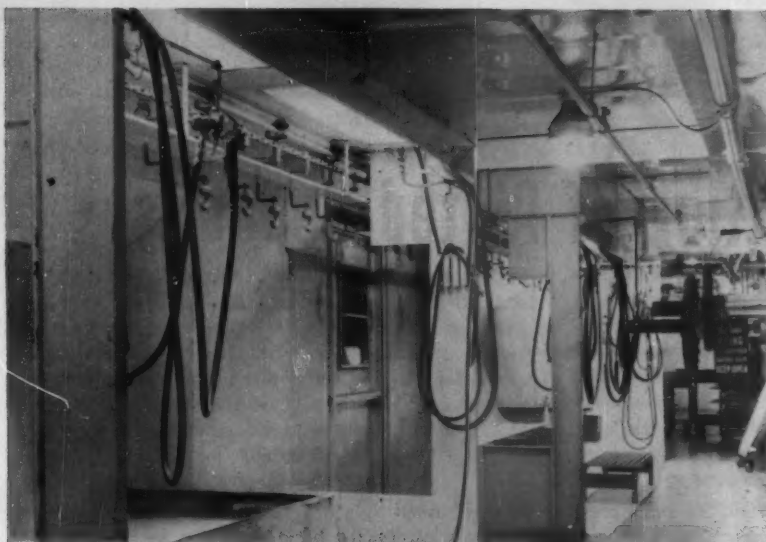
Actual painting begins with application of zinc chromate or surfacing primer at a two-man spray booth in the paint room proper. A two-minute flash-off period follows before parts reach an 18-foot water spray wall booth which has three stations and where the finish is applied.

Masked parts and others which need special finishing, such as the application of a customer's paint, pass to a two-man, 14-foot batch booth; then on to an 8' x 8' x 24' batch oven normally maintained at 250-300°F. This oven has doors at each end so that batch trucks can be loaded in the paint room and unloaded in the wet-sanding inspection preparation area. The trucks, which ride on rails, can be removed without workmen having to enter the hot oven.

The next stage in normal production is the entry of parts into the 8' x 8' x 100' main drying oven. Temperatures up to 350°F. are controlled remotely by recording-type temperature controllers. Temperatures are held to within plus or minus two degrees Fahrenheit. A three inch blanket of insulation around the oven minimizes heat losses.

Parts loop through the main

Wet sanding operation takes place on these specially-constructed island tables.



Paint room, showing priming booth in foreground and finishing booth beyond.

oven for a total run of 200 feet. Thus, for example, if conveyor speed is set at five feet per minute, baking time is 40 minutes. A heat of 275°F. is typical for many parts going through the main oven.

A normal cycle is completed after parts are removed from the conveyor at the end of the baking period, inspected and passed on to the sanding areas. Accepted parts are silk screened, some with circuit diagrams, wrapped and sent to live storage.

Routine production requires the use of four major colors and one standby color. Finishing materials are zinc chromate primer, surface primer, and enamel. These are pre-formulated by the vendor so that no in-plant processing is required. Paint is pumped directly from 55-gallon drums in the paint supply room, and thinner via separate lines to all spray stations.

Paint formulation is based on a spraying temperature of 180°F., maintained by a circulatory hot water system working through each individual paint spraying station. Specially constructed delivery hoses distribute paint from heat exchangers to stations. Hot water from the exchangers is pumped to and from spray guns parallel to supply lines in order to maintain temperatures. Paint supply lines are made of half-inch black iron tubing with all bends and turns formed to assure an uninterrupted flow of material.

The paint room is conditioned and pressurized with one-eighth-inch water column above atmosphere of filtered air. Make-up of 60,000 cfm is maintained at 72°F. Air is filtered on both the intake and

discharge side of blowers to eliminate most of the airborne dust and dirt. About 45,000 cfm is exhausted through spray booths and other openings.

The interior of the main spray room is painted with three coats of white high-gloss enamel and the floor is vinyl tiled. To maintain cleanliness, all operating gear, paint pots, regulators, heat exchangers, and valves are remotely located outside the "clear room."

Conveniently-located stop stations can shut down the entire system completely in event of emergency. There are also five strategically-located conveyor stops. The area is surrounded by a one-hour fire wall and protected by sprinklers, emergency blankets, and fire extinguishers of both the CO₂ and dry chemical types. Materials are retained in approved safety containers. Individual electric motors are equipped with lockout switches.

The installation includes 34 electric motors from one-half to 30 HP, with a total of 100 HP. All motors are controlled from a single master panel incorporating all contactors and starters. Electrical distribution from the panel throughout the department is via overhead distribution gutters and branches.

Planning and construction supervised by Ampex executives and engineers is believed to have resulted in overall construction savings of approximately 20 per cent. The department represents a cost of about \$160,000.



Bench workers at the dry sanding tables.

Pores and Pitting of Plated Deposits

By Dr. J. M. Odekerken, *Plating Chemie N.V., 's-Hertogenbosch, Holland*

IN the finishing industry where metals, for some reason, are plated with other, more or less precious metals, continual efforts are made in order to keep deposits free from pitting and pores, as much as possible.

Obtaining deposits which are practically without pitting and pores is one of the main problems in the electroplating industry. Since a plated deposit is worthless if the prevalence of pitting and pores surpasses a certain limit, the origin as well as the prevention of these symptoms are thoroughly studied, especially in the U. S. A.

Definitions of Pores and Pits

In the technical literature, descriptions of these symptoms can be found which may easily lead to misunderstanding, since the terminology seems to be quite befuddled. It is certainly wrong to make distinctions such as a pit being macroscopic and a pore microscopic. In general, it can be maintained that a pore is a slight interruption of the metallic deposit which, as often as not, can be seen with the naked eye.

A pit is a pore as well, but its origin is different, since it is formed during the plating process by gas bubbles which interrupt the regular growth of the deposit. In most cases pitting can be seen with the naked eye and, consequently, can be considered as a larger kind of pore. One often notices that pitting or gas pores have a characteristic form which makes it easy to distinguish the way in which the gas bubbles try to escape upwards.

The term "dirt-pitting," which is often used, certainly does not make the difference between pores and pits quite clear. At times, the expression "dirt-pitting" is adapted to indicate normal pores, whereas, others use it for real pitting where the bottoms of the pits show a dark color. The difference between pits and pores becomes very clear when describing the causes of both symptoms.

The Consequences of Pores and Pitting

When plating an iron object with nickel, the basis metal will be covered completely if no pores and pitting would appear so that, with regard to corrosion-resistance, the iron object would be equal to a massive nickel article. However, in most cases, the deposit will

be interrupted by pitting and pores and, on these unprotected places, the basis metal can be involved in a chemical or electrochemical reaction. In this case the more noble metal will act cathodically and the other metal anodically. An example is the combination zinc-plated iron, where zinc will become anodic and be dissolved, whereas, iron becomes a cathode at which hydrogen is evolved. As long as anodically acting zinc is left, the iron will be protected.

We can conclude that the corrosion-protective value of a less noble metal is directly proportional to the thickness of the deposit. If we consider the combination tin-plated iron, however, tin (being the more noble metal of the two) is cathodic and iron the dissolving anode. The combination where the coating metal is more noble will be far more critical, since interruption of the deposit will mean acute danger. It is interesting to draw attention to the fact that, in the combination tin-iron, tin may also act as a dissolving anode, for instance in slightly acid fruit-juices. In practice the base metals, therefore, are plated with more noble metals only if there are still other reasons than mere corrosion-resistance, for instance, nickeling of bicycle parts and plating with tin in the canning industry.

Because pores in the nickel-iron combination are very dangerous and nickel is one of the most commonly plated metals, special attention will be paid to it when discussing causes of pores and remedies in general. The number and the extent of the interruption of the deposit are most important when plating base metals with noble metals, as previously mentioned.

Thickness of deposit itself seems to be but secondary, as one would be inclined to think the thickness should be sufficient only to resist wear during a certain period. Taking into consideration, however, that there is a direct connection between thickness of deposit and the number of pores, it is evident that thickness is not secondary but, on the contrary, of vital importance, especially where noble metals are adapted for plating purposes.

Although pores play an important part, one should not exaggerate their importance and presume, for instance, that a nickel deposit free from pores and of the right thickness is decidedly good. There have been manufacturers who guaranteed the excellent quality of

their nickel deposits merely on basis of this factor, but this proved to be an error. Not only thickness and porosity will influence corrosion-resistance. The internal stress, hardness, lack of homogeneity, impurities in the deposit, and various other factors can influence corrosion-resistance to a great degree.

Corrosion-tests will give more information where corrosion-resistance of the article in question is concerned, because the other factors, such as indicated previously, will also be disclosed. However, one will often find, when making corrosion-tests, that there is no connection whatsoever with real atmospheric conditions, since minute impurities in the air, which have no influence on the accelerated test, are in reality very important. A few of the well known testing methods, such as tropical and artificial climates, have proved to be very successful and satisfactory, however.

Causes of Pores and Pitting

Pores and pitting can be attributed to basis material, chemical pretreatment, and the plating solution.

BASIS MATERIAL:

Basis material as one of the causes can be subdivided as follows: a) pores already present in the raw material, and b) inclusions in the base metal with bad conductivity.

a) Pores already present in the raw material.

On very porous metals, the deposit will be even more porous. Unevenness, scratches, roughness, pores in the metal surface, improper or insufficient polishing, overpickling, etc. will always have a bad influence on the number of pores of the deposit.

b) Poorly or non-conducting areas on basis metal.

It is quite clear that non- or poorly-conducting areas will receive less deposit or none at all so that, on the areas in question, no deposit or a small recess will be formed. These areas in the basis metal can be caused by the presence of oxides, scale due to rolling, residues of polishing compounds, etc.

CHEMICAL PRE-TREATMENT:

Ineffective or incorrect chemical pretreatment can also be the cause of non- or poorly-conducting areas. When the articles are insufficiently cleaned, pitting will often be the result because spots on the article in question are still covered with grease. If the objects have been overpickled, a carbon film is produced which will cause a very porous deposit.

Not only the normal pores are due to the points just described, but also gas pores or pitting. In this case gas bubbles will attach themselves to scratches and other unevennesses or to poorly-conducting areas, preventing formation of a deposit. Moreover, in local occlusions in the basis metal, the hydrogen overvoltage is smallest, so that such an area will now form a gas pore or pit anyhow.

Pores which are due to defects in the base material reach the surface of this basis metal. These pores can be closed on the outside by increasing the thickness of the deposit or by the leveling action of the plating solution. On irregularities of the surface, small gas bubbles are likely to attach themselves quickly, so that pitting

also is easily produced. Hence the condition of the basis metal, which causes pores, can also lead to pitting if certain areas also come into contact with gas.

PLATING SOLUTION:

The plating solution itself may provoke formation of pores and pitting on account of: a) suspended material, b) dissolved impurities, or c) other reasons.

a) *Suspended material:* It is logical that suspended material, which attaches itself to the basis metal or to the growing deposit, may cause non-conducting points, on account of which pores may be formed. Important factors which are detrimental to a good deposit are dust (if the plating shop is not sufficiently ventilated); anode-sludge (from bad anodes, incorrect anode current density, or use of anode-bags of inferior quality), and insufficient chloride ions in the nickel solution; and rust or scale emerging from the inside of tubes into the solution are likely to favor formation of pores, as does calcium sulfate which is precipitated out of hard water at high bath temperatures. Many of these undissolved impurities migrated towards the cathode by electrophoresis.

b) *Dissolved impurities:* These impurities can be subdivided into inorganic and organic compounds. As to the inorganic elements, iron, lead, and chromic acid in the nickel-solution, are especially important. The metallic impurities can react in exactly the same way as suspended components in the cathode-film where, on account of the high pH, these metals are considerably less soluble. Chromic acid will give rise to pores and pitting in the same solution, because of an increased cathode potential, so that nickel plates out more slowly and more hydrogen is developed.

The dissolved inorganic substances which form hydroxides, as well as the dissolved organic impurities, are important sources of pitting, since they increase the adhesion of the gas bubbles to the cathode. Also, here we discover a certain relationship between impurities and gas bubbles, which was also found when pitting was due to the conditions of the basis material. This gas can be either hydrogen that is developed on the cathode during the plating process, or finely divided air which enters the solution through badly functioning filtering equipment, or by addition of cold water to a warm bath, causing air to escape. The gas bubbles rise with a speed and force directly proportional to the size of the bubbles. Opposing powers are the adhesion to the object and the viscosity of the bath. If the adhesion is strong enough, for one reason or another, the gas bubbles will remain attached to the object and form pits. Adhesion, for instance, can be increased by basic iron-compounds or organic impurities on the cathode.

Examples of organic impurities are oil and grease from polishing compounds, excess brightening agents, organic substances from new, unwashed anode bags, organic substances from untested plastic tank lining, filter equipment, etc. Pores which are formed during the plating process itself, will not always reach the base. The pores, in this case, start somewhere in the deposit and can reclose, so that a pore is produced which is closed both at the top and at the bottom.

c. *Other factors:* Herein are included incorrect bath-compositions and operating conditions in the plating

bath, which may lead to formation of pits and pores. As such one could mention too low a metal content, insufficient antipit, excessive current density, too high pH and too little boric acid in nickel baths; slow covering rate, poor covering power, etc. Often these factors provoke the causes previously mentioned (for instance, suspended material) and thus, indirectly occasion pores and pitting.

Both in the basis metal and in the deposit, polarized areas can be present in the same material. Its cause can be both chemical and physical, for instance occlusions of oxides, organic substances, and areas with different sources of energy because of mechanical transformation, etc. On account of this local-element-formation in the material itself, corrosion and pores can be produced.

It is evident that these pores, which have great influence upon the corrosion-resistance of the plated object, can hardly, or not at all, be traced by means of porosity-tests. The porosity test itself, for tracing the pores present, can decidedly not be considered worthless, however. Yet, the objections which have been made in the last few years against the old test-methods (for instance the Ferroxy test) are well-founded. These objections are made principally with regard to the aggressive character of the porosity test and the fact that smaller pores, through which no liquid can emerge, are not readily shown. The old ferroxy test indicates only the larger pores which continue completely through to the basis material.

Tracing the Cause and Origin of Pitting

If, in practice, one is confronted with a serious problem of pores and pitting, the following factors might be the origin of the defects and should be considered.

- I. Base material
 - a) porous base material or poor mechanical pretreatment
 - b) occlusions in material
- II. Chemical pretreatment.
- III. Plating solution
 - a) suspended material
 - b) dissolved impurities
 - c) improper solution or working conditions.

Before studying the problem any further, the aforementioned possible causes of pitting and pores should be considered. One should check whether the plating solution is in good condition, has the right composition and is operated according to instructions. With a bright solution one should see to it that both solution composition and the brightener contents are right and that plating is done at the correct pH, current density, and temperature. As to the bath composition, the nickel sulphate, boric acid and non-pitter are most important. By keeping them at the right level, cause III c. can be excluded.

When, in spite of correct solution and working conditions, pitted deposits are formed, one should convince oneself whether this can be attributed to cause I, II or III. To get an idea of the possible causes, a few polished brass or heavily coppered articles are plated after they have been thoroughly cleaned and dipped in a fresh acid.

A few tests will show whether or not the plating solution is the cause of the trouble. Let us presume that no pitting and pores are to be seen when making these tests, so that apparently conditions I or II are the culprits. We then take a few articles, on which these defects are visible, and plate them with a heavy copper deposit, after which a few are buffed, thoroughly cleaned, scrubbed with Vienna lime, and given a clean acid dip. The rest of the articles are cleaned and acid-dipped in the usual way. When both kinds of articles prove to be equally satisfactory, pitting and pores are to be attributed to the base material (I). When only the objects which were given a special treatment are good, then it is likely due to a poor or incorrect chemical pretreatment (II).

Assuming that the basis metal itself is the origin of the trouble (I) one has to find out whether this is due to an inferior quality of the material or to the mechanical pretreatment (polishing). A better choice of material or, in some cases, even a copper strike, application of a special acid dip, etc. will solve the trouble. Should the mechanical pretreatment be insufficient or altogether incorrect, this must be improved, of course. Should the chemical pre-treatment be ineffective, one should try to find out which of the various baths is at fault. A few hints in this direction are:

- cleaning solutions too old.
- cleaning time too short.
- cleaning temperature too low.
- insufficient rinsing.
- grease film on rinsing baths or acid dip.
- acid dip too old.

When it turns out that the plating solution is not in good condition, one should investigate whether it is contaminated (III b).

A turbid or dirty solution will always give porous deposits, often including roughness on the horizontal surfaces. Pores and pitting due to dissolved impurities are easily detected by means of a Hull cell test. It is often accompanied by other defects, such as burning, bad throwing power, brittleness, black deposits in low current density areas, etc. As a result of the last-mentioned symptoms, and a few tests, one can easily determine which remedy should be adopted. For instance, plating out on dummy cathodes at low current density, or a purification with activated carbon or potassium permanganate together with activated carbon, eventually combined with high pH treatment.

Electropolishing

Less Commonly Electropolished Metals

By John F. Jumer

Electro-Glo Co., Chicago, Ill.

Since the publication of the second installment in our September issue, Mr. Jumer has furnished us with some additional formulae and data, which now appear as Part III.—Ed.

THE following listing is a fraction of the various formulas and methods described in patents and other literature. The intention is to present a cross-section of those most commonly employed commercially and metallographically.

Some formulas may not be ideal for commercial applications, but may well serve as a starting point toward more practical solutions.

A complete listing of patents and patentees has not been included in this article. No representation is made concerning the presence or absence of risk of patent infringement arising from practice of any of the processes discussed. The discussion of these electropolishing solutions does not constitute any recommendation as to results.

Cadmium

1. Potassium cyanide _____ 120 g./l.
Cadmium hydroxide _____ 20 "
Amp./ft.² _____ 111-233
Voltage _____ 4-5
Temperature _____ 70°F.
2. Orthophosphoric acid _____ 450 cc.
Water _____ 550 "
Amp./ft.² _____ 45-1400
Voltage _____ 2
Temperature _____ 68°F.
Cathode _____ Nickel

Note: Agitation necessary.

Gold

1. Potassium cyanide _____ 9 oz./gal.
Rochelle salt _____ 2 "
Potassium ferrocyanide _____ 2 "
Phosphoric acid _____ 2½ "
Ammonia _____ 10 cc.
Voltage _____ 9-10
Temperature _____ 200°F.
Cathode _____ Stainless Steel

Note: Agitation required.

2. Thiourea _____ 25 g.
Sulfuric acid _____ 3 cc.
Glacial acetic acid _____ 10 g.
Amp./ft.² _____ 14-33
Temperature _____ 68-113°F.

Magnesium

- Hydrochloric acid _____ 100 ml.
Ethylene glycol _____ 900 "
Amp./ft.² _____ 20
Voltage _____ Initially 10-15 > 5
Temperature _____ Below 50°F.

Note: Dilute nitric dip removes film.

Platinum

- Hydrochloric acid _____ 20%/vol.
Sodium chloride _____ To Saturation
Amp./ft.² _____ 450 Minimum
Voltage _____ 1-5
Temperature _____ 75°F.
Cathode _____ Platinum

Silver

1. Potassium ferrocyanide _____ 60 g./l.
Sodium cyanide _____ 60 "
Amp./ft.² _____ 140-230
Voltage _____ 6
2. Silver cyanide _____ 35 g./l.
Potassium cyanide _____ 37-70 "
Potassium carbonate _____ 38-40 "
Amp./ft.² _____ 20
Voltage _____ 2.5-3.5
Time _____ 10 minutes

Note: Controlled agitation and current density required for these solutions. Stainless steel cathodes allow silver recovery by stripping.

Tantalum

- Hydrogen fluoride _____ 4%/wt.
Hydrogen chloride _____ 34%/wt.
Water _____ Balance
Amp./ft.² _____ 3600 minimum
Temperature _____ 70°F.
Time _____ 10 minutes

Note: Extreme high current density is necessary to overcome the valve action of tantalum.

Titanium

1. Phosphoric acid (90%) _____ 45-85%/vol.
Hydrofluoric acid (50%) _____ 10-18% "
Methanol _____ 5-40% "
Amp./ft.² _____ 500-1000
Voltage _____ 8-17

Note: High methanol content destroys luster.

2. Hydrofluoric acid (50%) _____ 160 cc./l.
Chromic acid _____ 500 g./l.
Amp./ft.² _____ 185-465
Voltage _____ 3-7
Temperature _____ 60-68°F.

(Continued on page 70)

Electrochemical Society Meets in Ottawa

THIS article lists abstracts of papers which were presented at the 114th meeting of the Electrochemical Society held at the Chateau-Laurier Hotel, September 28th to October 2nd.

Direction of Ionic Movement in the Anodic Oxidation of Aluminum

J. E. Lewis and R. C. Plumb, *Alcoa Research Labs., New Kensington, Pa.*

It is demonstrated, by a series of marker experiments in which layers of nonporous anodic oxide were tagged by incorporating radioactive material in them, that nonporous anodic oxide grows at, close to, the oxide-electrolyte interface; it is concluded that the aluminum ion is the mobile species. Similar experiments with a porous oxide may also be interpreted in terms of formation of the oxide at the oxide-electrolyte interface, but in this case the interface is at the bottom of pores filled with electrolyte.

Observations on the Anodic Oxidation of Aluminum

R. C. Plumb, *Research Group on the Physics and Chemistry of Solids, Cambridge University, Cambridge, England (Present Address; Alcoa Research Labs., New Kensington, Pa.)*

The anodic conversion of aluminum oxide is essentially quantitative in a buffered neutral electrolyte containing no halogen ions. Film thickness is proportional to the voltage gradient. The film contains a quantity of the anion from the electrolyte. The coulombic transfer during film formation is quantitatively accounted for by aluminum to the trivalent state and liberation of oxygen gas.

The Specific Surface Area of Aluminum as Determined with Continuously Variable Resolution from 20 to 1000Å

R. C. Plumb, *Research Group on the Physics and Chemistry of Solids, Cambridge University, Cambridge, England (Present address: Alcoa Research Labs., New Kensington, Pa.)*

A new technique for studying surface topography of metals that can be oxidized anodically is described. Coulometric measurements of the formation of films in steps as small as 20Å give a measure of the specific area with what may be described as variable resolution from 40 to 1000Å. Results are compared with work

described earlier by a radiochemical technique which has a resolution of about 20Å and with optical measurements made at resolutions greater than 1000Å. The shape of a surface area vs. resolution curve gives information about the topography of the surface.

A Study of the Structure of Anodic Oxide Films on Aluminum

D. J. Stirland and R. W. Bicknell, *Caswell Research Laboratories, Towcester, Northants, England*

The influence of the formation voltage on the structure of anodic aluminum oxide films has been studied by electron microscope and electron diffraction methods. It has been shown that low formation voltages (< 100 v) produce an amorphous oxide together with some crystalline γ' -alumina. The location of this crystalline oxide within the anodic layer is discussed.

Effect of Stripping of Anodized Coatings from Aluminum on Electrical Resistance

Walter Beck, E. D. Zavaglia, and S. J. Ketcham, *Aeronautical Material Lab., Naval Air Material Center, Philadelphia 12, Pa.*

Stripping of anodized coatings from aluminum by action of chromic-phosphoric or hydrofluoric-nitric acid mixtures was studied by surface resistance measurements, using a spring loaded probe electrode and Kelvin bridge circuit. The effect of stripping time on resistance was proved by statistical analysis to be significant. Based on the surface resistance, tentative calculations of distribution and area of pores in the coating were made and a mechanism of stripping action postulated which was supported by weight loss measurements, microscopic, and electron microscopic observations.

Films Formed by A-C Anodization of Aluminum in Sulfuric Acid Solutions

W. H. Fischer and J. A. Consiglio, *General Electric Co., Schenectady, N. Y.*

A pilot plant for the continuous strand annealing, cleaning, degreasing, and anodizing of aluminum wires has been constructed. The electrolyte is 40 wt % sulfuric acid. The effects of such process variables as annealing temperature, electrolyte temperature, residence time, and current density have been evaluated in relation to electrical and physical properties of the anodized coating. Progress to date indicates that an in-

sulated electrical conductor suitable for operation at temperatures up to possibly as much as 400°C. can be produced successfully.

Nickel-Aluminum Alloys Formed by Electrodeposition

Dwight Couch and Jean Connor, *National Bureau of Standards, Washington 25, D. C.*

Nickel-aluminum alloy coatings were produced by the electrodeposition of aluminum over electrodeposited nickel. The basis metal was steel. The aluminum was plated from fused salt baths operated from 170° to 1000°C. and from an organic bath operated at room temperature. The coatings had a hardness of about 700 Vickers and were much superior to nickel coatings for the protection of steel in salt spray tests. The oxidation of these alloys at 1000°C. was much slower than that of pure nickel. Attempts to codeposit nickel and aluminum from an organic type of bath were not successful.

On the Growth and Properties of Electrolytic Whiskers

P. B. Price, D. A. Vermilyea, and M. B. Webb, *Research Lab., General Electric Co., Schenectady, N. Y.*

The electrolytic growth of metal whiskers from solutions containing additives is examined, and a mechanism for their growth is proposed. It is assumed that adsorbed impurity molecules hinder the motion of atomic steps over crystal surfaces, and also that adsorbed molecules are incorporated into a growing crystal. A quantitative theory of the rate of growth of whiskers is in good agreement with experiment. Properties and structures of the whiskers are discussed.

A Radioisotopic Study of Leveling in Bright Nickel Electroplating Baths

S. E. Beacon and B. J. Riley, *Research Staff, General Motors Corp., Box 188, North End Station, Detroit 2, Mich.*

A radioisotope-containing addition agent has been synthesized and used as a component in a bright and leveling nickel bath. Investigation by autoradiography and various counting techniques shows that this agent is preferentially deposited at the high points of an irregular surface, thereby substantiating a part of leveling theory. The radioactive addition is also used in an attempt to better understand the mechanism of formation of laminations in this type of nickel deposit.

Electrodeposition of Porous Nickel

J. J. MacDonald, D. G. Gage, and E. C. Brown, *Dept. of National Defence, Defence Research Board, Naval Research Establishment, Dartmouth, Nova Scotia.*

In an attempt to simplify nickel-cadmium battery production, studies of the electroforming of porous nickel were undertaken with a view to replacing the normal sintered plaques. Plaques with up to 80% porosity have been electrodeposited reproducibly from

a Watts-type bath to which has been added lamp black or graphite. When tested as battery positives, the best plaques showed capacities 70% as high as those of sintered nickel plaques.

Electroplating of Nickel from the Pyrophosphate Bath

S. K. Panikkar and T. L. Rama Char, *Electrochemistry Lab., Dept. of General Chemistry, Indian Institute of Science, Bangalore-3, India*

The pyrophosphate bath has been studied in detail for the electrodeposition of nickel. It gives satisfactory deposits over a wide range of operating conditions. Potential measurements have been made and the throwing power determined. This bath is comparable to the commercial acid baths for nickel plating in respect to current density, current efficiencies, and quality of the deposit. It has a low nickel content, high throwing power, and is suitable for plating on zinc.

Electroplating on Group IVB-VIB Metals

E. B. Saubestre, *Central Research Labs., Sylvania Electric Products Inc., Bayside, N. Y.*

In a new plating method, the conventional etching step is eliminated. Instead, the substrate is treated cathodically to form a hydride covered surface, which permits good adhesion of thin nickel deposits. The hydride is then removed by a vacuum bake, followed by further plating as desired. It was found possible to plate over oxide-coated Nb and Nb-Ti alloys, without need for activation or post-plating baking operations. The oxide was applied by anodizing.

Novel Nickel Plating Process

J. T. N. Atkinson, *Dept. of National Defence, Defence Research Board, Naval Research Establishment, Dartmouth, Nova Scotia*

Following earlier work on electroplating on aluminum from strongly acid solutions, a new process for nickel plating aluminum was developed. Adhesion values of about 5000 psi in shear were obtained regularly, and still better adhesion could result from the use of a proper heat treatment. The process for plating nickel on aluminum was found to be surprisingly versatile. It appears to have industrial potentialities for general electroplating and electroforming operations with nickel.

Electroplating Metal Contacts on Semiconductors

D. R. Turner, *Bell Telephone Labs., Inc., Murray Hill, N. J.*

Various metals have been plated on germanium, silicon, gallium-arsenide, and titanate semiconducting oxide ceramics. These materials usually have oxide layers on them which could interfere with the intimate contact required between metal and semiconductor for good adhesion and the desired electrical properties. Oxide films and residues from chemical etching on germanium can be removed by cathodic reduction

prior to metal deposition in many plating solutions. Sixteen different metals were plated on n- and p-type germanium. Since oxide films on silicon are difficult to reduce cathodically, special techniques are required to produce adherent electrodeposits on silicon. "Electroless" nickel is used to make low-resistance ohmic contacts to silicon, gallium-arsenide, and semiconducting oxides.

Electrodeposition of Aluminum on Uranium*

J. G. Beach and C. L. Faust, *Battelle Memorial Institute, 505 King Ave., Columbus 1, Ohio*

Electroplating of aluminum was studied as an alternate method for aluminum cladding of uranium fuel elements. Uranium electroclad with 12 mils of aluminum over a 0.5-mil nickel or nickel-plus-copper electroplate resisted corrosion for more than 100 hr in boiling water. Hot pressing the electroclad composite improved the corrosion resistance. Many of the results obtained with aluminum electrocladdings paralleled those obtained with wrought aluminum claddings on uranium.

*Work performed under AEC Contract W-7405-eng-92.

Electroplating on Thorium*

J. G. Beach and G. R. Schaer, *Battelle Memorial Institute, 505 King Ave., Columbus 1, Ohio*.

A method was developed for treating thorium whereby adherent electroplates of most metals can be applied. The method involves anodic pickling in hydrochloric acid and chemical pickling in sulfuric acid prior to plating. Factors affecting the adhesion and protective quality of the electroplated coatings are discussed.

*Work performed under AEC Contract W-7405-eng-92.

Immersion Plating on Zircaloy 2

L. R. Kohan, *Armour Research Foundation, 10 W. 35th St., Chicago 16, Ill.*

Coatings of such metals as copper, iron, nickel, and tin have been deposited on Zircaloy 2 by chemical displacement from solutions containing low concentrations of hydrofluoric acid. The character of these coatings was suitable for subsequent joining methods. Bath variables were studied and it was found that small changes in agitation, temperature, and HF concentration greatly affected the coating thickness. Coatings up to a thickness of one mil were produced by this technique.

Electrocladding of Zirconium with Platinum*

A. B. Tripler, J. G. Beach, and C. L. Faust, *Battelle Memorial Institute, 505 King Ave., Columbus 1, Ohio*.

A method which included the use of periodic reverse plating was developed for electrocladding zirconium with sound, pore-free platinum coatings up to 1.5 mils in thickness. A smoother more protective platinum deposit can be plated over an intermediate diffusion-bonded nickel electroplate than can be obtained when platinum is plated directly on zirconium. On nickel,

platinum thickness of 0.5-0.75 mil appears adequate for corrosion protection in boiling HCl.

*Work performed under AEC Contract W-7405-eng-92.

Chromium Plating on Titanium Alloys

Charles Levy, *Watertown Arsenal Labs., Watertown, Mass.*

Electrodeposited chromium has been applied to commercially available titanium alloys using conventional plating techniques. Treatments prior to plating involved dry sandblasting and a zinc immersion coating process. The adhesion of the chromium deposits applied by these methods was compared with the adhesion of deposits applied by methods reported in the literature. Microscopic examination of the bond was the principal means of this evaluation.

Plated Coating on Titanium Gears

W. J. Hyink, *Research Div., Western Gear Corp., Lynwood, Calif.*

The procedures involved in electroless plating a phosphorus-nickel alloy on titanium and titanium alloy gears are discussed. Included are experimental preplate preparation methods, the chemistry of the electroless plating method used, and post plating procedures applied to produce a usable titanium gear after the plated coating has been applied. These experimental procedures are in compliance with a contract issued to the Western Gear Corp. in Lynwood, Calif., by the U. S. Air Force.

ELECTROPOLISHING

(Continued from page 67)

Tungsten

Sodium hydroxide	100 g.
Water	1000 ml.
Amp./ft. ²	30-55
Voltage	6
Temperature	68°F.

Note: Agitation necessary.

Zinc

1.	
Phosphoric acid	60%
Chromic acid	10%
Water	30%
Amp./ft. ²	4-100
Voltage	1-15
Temperature	125°F. maximum
2.	
Potassium hydroxide	25% Aqueous Sol'n
Amp./ft. ²	140-465
Voltage	2.5-6
Temperature	75-85°F.

Note: Air agitation. Control is critical.

Zirconium

Hydrofluoric acid	20 cc.
Nitric acid	10 "
Glycerol	200 "
Voltage	9-12
Temperature	75°F.

FINISHING POINTERS

The Use of a Coulometer

By J. B. Mohler

MANY times it is desirable to measure the quantity of current passed during electrolysis. The means of measurement depends on the accuracy desired. A record of the quantity of current passed through a plating tank simplifies bath control. The consumption of chemicals is related to the current passed more than to any other factor. Decomposition at the electrodes and the consumption of many addition agents are directly related. For a fixed cycle the area of work processed and, thus, the drag-out are also related. Bath adjustments are usually made on a basis of time. If the work load is steady this is essentially the same as on a basis of ampere-hours. For an unsteady work load an ampere-hour meter will simplify control.

For most practical plating one merely estimates the ampere-hours from the time and the current. With reasonable care attention to these variables will result in reproducibility to ± 10 per cent. This is sufficient for the majority of work plated. For precision plating or for cost savings, as in precious metal plating, an ampere-hour meter is used. Accuracy here is within a few per cent. An ampere-hour meter is also useful for better control of experimental work. Errors arise due to the drift of an ammeter, caused by resistance changes in the electrolyte, as well as similar changes in the external circuit. Much better reproducibility is obtained by the use of an ampere-hour meter.

For better accuracy a coulometer should be used. The coulometer is restricted to small scale experimentation, but almost any desired accuracy can be obtained. The classical coulometer employs silver nitrate and is accurate to 0.01 per cent when carefully used.¹ This instrument has been studied extensively as a means of investigating the accuracy of Faraday's Law.

For practical experimental work reproducibility within 1.0 per cent is often satisfactory. When such is the case, various common plating baths can be used. The bath must, of course, be one with a cathode efficiency of 100 per cent. The acid copper bath is popular for this purpose. However the silver cyanide bath is satisfactory and the lead fluoborate bath has been used.

It is relatively easy to set up a coulometer based on a practical bath. A typical plating arrangement utilizing several anodes and a cathode will suffice. The cathode is weighed before and after plating and the quantity of current is calculated from the increase in weight. This, of course, is based on the Faraday, which is 96,500 ampere-seconds or 26.8 ampere-hours. This quantity of current will deposit one equivalent

weight, or 107.88 grams, of silver. For the acid copper bath 31.77 grams will be deposited and, for acid lead, 103.6 grams. It can be seen that the gain in weight is about three times as great for lead and silver as for copper. However, this is not the only factor to be considered. For an accuracy of 1 per cent the precautions for good plating practice will be adequate. A good electrode arrangement, to favor uniform current distribution, is desirable. Also, the solution should be agitated for all but very thin deposits. For heavy deposits or maximum accuracy the anodes should be bagged.

A suggested cycle for the copper bath using a copper cathode is as follows:

1. Clean in an alkaline cleaner.
2. Rinse.
3. Pickle to a bright surface in nitric acid.
4. Rinse.
5. Rinse in alcohol and allow to dry.
6. Weigh.
7. Plate.
8. Rinse.
9. Rinse in alcohol and allow to dry.

The cathode can be reused directly if it is kept clean and not allowed to oxidize.

For the silver bath a similar cycle and a silver cathode can be used. A steel cathode is also satisfactory. It is not necessary to pickle a steel cathode, but it must be free from all grease and scale.

Lead Coulometer

A copper cathode, a copper plated steel cathode, or a freshly plated lead cathode can be used for the lead bath. If the lead bath is used without addition agents the deposit will be crystalline and metallic in color. If gelatine is present it will darken after plating. Good deposits can be obtained without addition agents, although the presence of gelatine does not appreciably change the weight of the deposit.

The lead coulometer is useful for composition control of a lead-tin alloy plating bath. For this purpose a lead coulometer is placed in series with a similar cell containing the alloy bath. Both cathodes are plated simultaneously and the analysis of the deposit is calculated from the ratio of the weights of the two deposits. One Faraday will deposit 59.4 grams of tin. Field and Weill² show that the composition can be calculated from the formula:

$$\% \text{ Sn} = \frac{135 (A-B)}{B}$$

where A = the weight of the lead deposit

B = the weight of the lead-tin deposit

Current quantities can be measured with a small error, employing these practical coulometers and, particularly, with the copper sulfate coulometer. However, it would be necessary to make a direct comparison with the silver nitrate coulometer in order to evaluate errors if the maximum accuracy is desired.

References

1. J. Am. Chem. Soc., **33**, 496 (1916).
2. Field and Weill, *Electroplating*, Sixth Edition, p. 474. Sir Isaac Pitman & Sons.

PHOSPHATING TREATMENTS*

A COMPREHENSIVE PATENT LITERATURE SURVEY

PART VII

By Ervin C. Tinsley**

488. *Protection of Metals from Corrosion.* By C. T. Roland (Hall Laboratories, Inc.). U. S. 2,528,787. November 7, 1950.

Treat ferrous, copper, zinc, and their alloys with an aqueous degreasing solution which contains at least 100 parts per million of at least one coating metal in the form of a water soluble salt and at least one molecularly dehydrated phosphate. The coating metals are calcium, strontium, barium, zinc, cadmium, nickel, cobalt or manganese. The ratio between the P_2O_5 content to the coating metal is between 0.031:1 and 7:1 and the pH value of the solution is maintained between 3 to 9.

489. *Process and Compositions for Applying Phosphate Coatings.* By P. Amundsen (Parker Rust Proof Co.). U. S. 2,540,314. February 6, 1951.

Aqueous immersion bath with the addition of a soluble chloride in the rate of 1 to 10 with zinc dihydrogen phosphate. The free to total acid is 1 to 20 and pH value between 1.5 and 4. This solution avoids sludge formation and consists of zinc oxide 11 parts; phosphoric acid (75%) 48 parts; $MnCl_2 \cdot 6H_2O$ 16 parts; and water 25 parts.

490. *Method of Phosphatizing Ferrous Surfaces.* By E. Snyder and F. P. Heller (American Chemical Paint Co.). U. S. 2,552,874. May 15, 1951.

Two successive baths are recommended to phosphatize ferrous surfaces. Each consists essentially of an aqueous solution of both primary and secondary phosphate of alkali metals or ammonium. Such as mono-ammonium phosphate 1.85 oz./gal.; disodium phosphate 0.15 oz./gal.; and an organic detergent 0.10 oz./gal. such as sodium lauryl sulfate.

To assure good coating the pH is adjusted between 4.7 to 6.2.

491. *Production of Phosphate Coatings on Metal Surfaces.* By R. F. Drysdale (The Walterisation Co. Limited). U. S. 2,554,139. May 22, 1951.

Coat iron and zinc solutions which consists essentially of at least one primary orthophosphate of zinc, manganese, or iron with the addition of at least a very small amount of the cations of two metals. One of the metals should be more basic than the metal being treated, and the other should be less basic than the metal being treated. The total amount of said cations in solution should be from 0.003 to about 0.04 grams per liter of solution. The additions of these cations decreases the treating time of the

immersed metal to 42% of the treating time required without the additive.

492. *Method of and Solution for Increasing Resistance to Corrosion.* By J. S. Thompson (Parker Rust Proof Co.). U. S. 2,564,864. August 21, 1951.

Treat surfaces of iron, zinc, or aluminum with solutions which consist essentially of acid aluminum phosphate, in which the content of PO_4 is 7 to 12 times by weight that of aluminum. The pH of the solution is from 1.9 to 4. Chromic acid can be added in amounts $\frac{1}{4}$ to $\frac{2}{3}$ as much as PO_4 .

493. *Method of and Solution for Coating Surfaces Chiefly of Zinc.* By H. K. Ward (Parker Rust Proof Co.). U. S. 2,591,479. April 1, 1952.

An aqueous solution of zinc dihydrogen phosphate containing 0.3% Zn and 1% PO_4 , nickel sulphate (0.3% Ni), sodium fluoborate (0.3%), and sodium or zinc nitrate (0.3%). The zinc nitrate is used to control the ratio between Zn and PO_4 in the solution. The immersion time from 15 seconds to 1 minute at 150° F. This solution can also be used as a spray solution.

494. *Method of Manufacturing of Phosphate Coating Products for the Protection of Metals Against Corrosion.* By Ole Thome-Johannesen (Eivind Eckbo). U. S. 2,597,406. May 20, 1952.

Method of producing phosphate containing coating products in a form whereby they can be stored in powder form. The components 35 kilograms zinc triphosphate, 40 Kg. monobasic calcium phosphate are mixed in powder state and then 2-Kg of water is added. The material is mixed continuously then dried and pulverized. This product is stored and then mixed with water when used.

495. *Protecting Metals Against Corrosion.* By Josef M. Michel and Karl F. Hagler (To U. S. as represented by the Sec. of Army.) U. S. 2,602,760. July 8, 1952.

Iron and low-C steel were treated for several hours with an emulsion formed from 10 grams of Na octadecylsulfaminoacetate in 90 grams of water, and this solution adjusted to pH of 5.5 with H_3PO_4 .

496. *Phosphate Coating of Metals.* By Robert C. Gibson (Parker Rust Proof Co.). U. S. 2,609,308. September 2, 1952.

A solution which produces an extremely thin ferric phosphate coating which is ideal as a paint base. The solution is free from sludge while maintaining a high pH. The solution is prepared by dissolving 113 lbs. of NaH_2PO_4 in 900 gals. of water and adding sufficient $NaClO_3$ to furnish 0.5% ClO_3 .

In use it is heated to 160° F and the pH is maintained after use at 5.2.

Forrest J. Whitney, Jr. (Heintz Mfg. Co.).

497. *Cold-Drawing Sheet Metal.* By U. S. 2,613,626. October 14, 1952.

Sheet metal is cold-drawn by providing a phosphate coating applying a lubricant, and drawing the metal by means of dies. The phosphate bath, used at pH 2.8 to 2.9 and 20-5° for 3-5 minutes comprises Zn 11.0, P_2O_5 9.95, NO_3 18, NO_2 1.5, Ni 0.1, Cu 0.03, and $NaNO_3$ 1-1.5 of 1 liter.

498. *Vibratory Cleaning of Objects.* By Maurice M. E. Bourgeaux (Societe Anonyme des Manufactures des Glaces et Produits Chimiques de Saint-Gobain, Chauny and Cirey). U. S. 2,616,820. November 4, 1952.

The method of cleaning and phosphating a metal object that includes the step of subjecting the object to elastic, mechanical 50,000 periods per second in contact with phosphoric acid solution.

499. *Ammonium Chromate Rinse for Phosphate-Coated Metal Surfaces.* By Harry J. Benzing (American Chemical Paint Co.). U. S. 2,634,225. April 7, 1953.

This patent involves the replacement of H_2CrO_4 with $(NH_4)_2CrO_4$ or $(NH_4)_2Cr_2O_7$ in a solution containing 1.40 oz. of the chromate per 100 gals. of water. The operating pH range of the rinse 4.0-9.1, and claims the retention of the phosphate coating and an improved corrosion resistance.

500. *Protective Finish for Metals.* By James G. Ford (Westinghouse Electric Corp.). U. S. 2,636,257. April 28, 1953.

A protective finish for metals consists of (1) primer, (2) an intermediate coating, and (3) a finish coating. The finish is applied preferably to a phosphate treated metal. This is a synthetic resin coating containing at least 25% by weight of phosphates, and Fe_2O_3 equal to 10-75% of the weight of the suitable inhibitors that are added.

501. *Corrosion Resistance Phosphate Coating.* By Montagu Hyams and Andrew Nicholson (Parker Rust Proof Co.). U. S. 2,657,156. October 27, 1953.

Corrosion resistant coatings suitable for painting are obtained by treating ferrous surfaces with H_3PO_4 or alkali phosphate (0.05 - 0.25M) to which certain organic nitrocompounds have been added. Ni-nitrobenzene sulfonic acid (0.5 - 25%), 4 chloro-3-nitrobenzenesulfonic acid (502%) 3 nitrophthalic acid (0.02 - 1%) in nitrobenzoic (NO_2 -1%) or hydroxylamine salts (0.1-0.5%). The pH must lie between 4.2 and 5.8 and the temperature be above 60°. Treatment is followed by a chromic acid dip.

502. *Coating Process with Alkali Metal Phosphate and Added Fluoride Salt.* By Paul L. Amundsen and Walter A. Osip (Parker Rust Proof Co.). U. S. 2,665,231. January 5, 1954.

A method for coating metal surfaces such as iron, steel, zinc and alloys thereof, the novel step of subjecting the metal to the action of an aqueous coating solution which essentially consists of an alkali metal phosphate and an activator comprising alkali acid fluoride being balanced to maintain the pH of the solution between 3.0 and 5.8 the concentration of the phosphates in the solution being between 15 and 95 percent by weight of the total chemical in solution.

*The opinions or assertions contained herein are not to be construed as being official or reflecting views of the Department of the Army.

**Ordnance Corps, Metal Finishing Laboratory, Rock Island Arsenal, Rock Island, Ill.

503. *Coating Compositions for Metals Containing a Phenol Formaldehyde Resin and a Phosphate*. By Robert H. Strum (Cosmocord Plastics Limited). U. S. 2,668,158. February 2, 1954.

A liquid coating composition for application to surfaces of steel, other ferrous metals, zinc, aluminum or alloys thereof comprising a homogeneous mixture of a thermosetting phenolformaldehyde resin with a modifying agent selected from the group consisting of natural resins, abietic acid and methyl abietic, together with an acidified metal phosphate and phosphoric acid, said metal phosphate being adapted to react with a metal surface to which the composition is applied to form an insoluble phosphate layer therein and also to act with phosphoric acid as a thermo-setting catalyst during storing.

504. *Improving the Phosphate Coating of Iron and Steel Surfaces*. By William A. Callahan and Frank L. Gendernak (Detrex Corp.). U. S. 2,674,552. April 6, 1954.

Licorice extract is used as an accelerator in the preparation of phosphate coating. In a given example 93 g NaHPO₄, 2 g licorice extract, and 5 gr H₃PO₄ are dissolved in 5 liter H₂O. The solution is agitated and heated to 160-180° F. The part is immersed for 10 min. and produces a bluish iridescent coating and corrosion resistance.

505. *Phosphate-Coated Asbestos-Cement Siding Shingles*. By Clarence R. Eckert and Phillip S. Bettoli. U. S. 2,683,096. July 6, 1954.

The shingles consist of a base of portland cement and asbestos fibers, a priming coat of AlCl₃, and an outer coating of an in-durated, insolubilized-reaction product of a mixture of Al hydrate, H₃PO₄, H₂O and inorganic pigments. The phosphate coating is highly resistant to retrogression, durable, weather-resistant, hard and glossy and adheres firmly to the base.

506. *Chemical Treatment for Metallic Surfaces*. By Ernest P. Bell (Parker Rust Proof Co.). U. S. 2,692,840. October 26, 1954.

A corrosion-resistant coating and paint base for steel, Zn and Al is described. No free H₃PO₄ is present, hence the mixture can be provided in a single package with a storage life of at least 6 months. The chemical composition is essentially 2-16% ZnCrO₄ 4Al(OH)₃; 2-16% polyvinyl butyral, polyamide resin, a suitable solvent, and 2-20% of a phosphate of the structure R OP (:O) (OR) OH. The pH of the compound is 6-9 and the thickness of the film is 0.1-0.8 mil.

507. *Treating Metal Surfaces to Improve Corrosion Resistance and Paint Bonding Ability*. By James H. Thirsk (American Chemical Paint Co.). U. S. 2,698,266. December 28, 1954.

Al and other metal surfaces, which have been treated previously with chromic-phosphoric solutions can be given additional corrosion resistance by an after-rinse consisting of an aqueous solution containing 0.4-4.0 g./l. CrO₃ and 0.2-2.0 g./l. ceric nitrate.

508. *Phosphates and Hydroxylamine in Ferrous Coatings*. By Montagu Hyams and Andrew Nicholson (Parker Rust

Proof Co.). U. S. 2,702,768. February 22, 1955.

A solution in 100 gallons of water, of 15 lbs. of H₃PO₄ (75%) and 3 lbs. hydroxylamine hydrochloride, brought to a pH 4.8 with NH₄OH, was sprayed at 170-180°F on to a ferrous surface. Immersion for ½ min. in 100 gal. H₂O containing 10 oz. CrO₃ at 160°F followed. This yielded a 150-200 mg./sq. ft. corrosion resistant coating suitable as a base for painting or lacquering. Other phosphates work also. The phosphate may vary from 0.05 to 0.25 molar, the hydroxylamine from 0.1 to 0.5% and the pH from 4.2 to 5.8.

509. *Treatment of Aluminum and Aluminum Alloys Before Spot Welding*. By Louis McDonald and Alfred E. Hawley (Kelite Products, Inc.). U. S. 2,710,792. June 14, 1955.

The preferred composition consists of: citric acid 7.9, 28% Be NH₄OH 7.1, Xylene-sulfonic acid 10, H₃PO₄ 37.5, and H₂O 37.5%. This mixed and diluted with an equal volume of water. Treatment at 25-45° for 2-20 min. is relatively noncritical with respect to time or temperature and is non-toxic. Satisfactory welding of the etched sheets can be accomplished as much as 48 hours after treatment.

510. *Phosphate-Chromate Corrosion Protection in Water Systems*. By Harry L. Kahler (W. H. and L. D. Betz). U. S. 2,711,391. June 21, 1955.

The tendency for water to corrode metals is reduced by the addition of soluble phosphates plus soluble chromates. The results show considerable improvement over the use of either phosphates or chromates alone. Best results are obtained with a pH between 5.5 and 7.8, a chromate concentration between 15 and 25 ppm, a phosphate concentration between 30 and 50 ppm, and a phosphate to chromate ratio of 2:1.

511. *Coatings for Steel to be Formed*. By Gilbert H. Orozco and Richard F. Ray (Pennsylvania Salt Mfg. Co.). U. S. 2,712,511. July 5, 1955.

Steel is prepared for forming, stamping or drawing operations by applying a microporous film which bonds itself chemically to the stock. The film may improve the adhesion of a subsequent lubricating film or may itself serve as a lubricant. A film which in itself is nonlubricating is produced in a solution consisting of oxalic acid, 25; 85% phosphoric acid, 10; hypophosphorous acid, 1; and water, 1000 parts. The steel is dipped in the solution for (approx.) 3 minutes at 200-5° F to form a microporous chemically bonded film. A lubricating coating is then applied before forming. To provide a lubricating film in one step, a non-reactive lubricant is added in the form of an acid soluble ester of a complex alcohol (e.g. polyethylene glycol phosphate, glycerol phosphate, etc.). To the previously described bath 10 parts of the ester is added. For thin surface films the oxalic acid concentration is 10 parts as compared to 25 parts for thick films, while the H₃PO₄ concentration is 10 parts for thin films and 5 parts for thick films.

512. *Phosphating Composition*. By D. E. Miller (Kelite Products, Inc.). U. S. 2,715,059. August 9, 1955.

A process of producing a dry orthophosphate compound as discrete particles, which

process comprises agitating granular anhydrous sodium acid pyrophosphate together with substantially 85% phosphoric acid in proportions of 1 part of the anhydrous sodium acid pyrophosphate to between 1 and 2 parts by weight of the 85% phosphoric acid, the agitation being conducted at a temperature of about 140°F.

513. *Preparation of Aluminum Articles for Painting*. By Willard G. Axtell (Shwayder Bros. Inc.). U. S. 2,721,835. October 25, 1955.

Aluminum articles are treated electrolytically in an aqueous bath containing 1.68% H₃PO₄ and 0.3% CrO₃ before painting or enameling. The electrolysis, with the article as the anode, is for 15-30 seconds at 2-30 volts with the bath at room temperature and at a pH of 2.3. The initial current is extremely high, but drops nearly to zero in a few seconds. Washing and drying are not necessary. The articles may be dipped or sprayed immediately.

514. *Phosphate Conversion Coating*. By W. S. Russell (Parker Rust Proof Co.). U. S. 2,724,668. November 22, 1955.

A composition of matter for forming by spraying a phosphate coating on metallic surfaces which consists essentially of an aqueous alkali metal phosphate solution containing an oxidizing agent, and .01% to 2% of an alkali metal lignosulfonate, acid solution having a pH of 4.2 to 6.0.

515. *Multiple Action Lubricating Composition*. By Ludwig K. Schuster and Harvey Aurand. U. S. 2,739,915. March 27, 1956.

A multiple action lubricating composition for application to a steel work piece of ferritic crystal structure, to provide on the work piece both a chemically deposited coating capable of providing a high degree of separation work and tool during cold working of the piece. The solution composition consists of: 21.6% organic amide lubricant (1 mole glycerine mono-fatty acid ester and 2 moles fatty amide); 9.6% phosphoric acid (70%); 18.8% acid zinc phosphating solution (containing 178 gram Zn/liter and 1200 gram H₃PO₄/liter); and 1200 gram H₃PO₄/liter; and 50.0% water.

516. *Phosphate Coating for Electrical Steel*. By Hans A. Steinberg (Westinghouse Electric Corp.). U. S. 2,743,203. April 24, 1956.

The process of providing an insulating coating on ferrous sheets, applying to the surfaces an aqueous solution comprising from ½ to 10% by weight of aluminum hydrate 5 to 50% by weight of phosphoric acid (85%) and the balance water, the pH of the solution being more acid than 0.8, the ratio of H₃PO₄ to aluminum hydrate being at least 4.5 to 1 by weight, and heat treating the applied solution at 135 to 500°C to drive off the water and to produce an adherent insulating coating.

517. *Phosphate Metal Coatings*. By William S. Russell (Parker Rust Proof Co.). U. S. 2,743,204. April 24, 1956.

A solution for producing phosphate coating on metallic surfaces consists essentially of a phosphate of a metal selected from the group consisting of iron, zinc and manganese, and an acetic amino acid, and having a pH range of about 1.9 to 3.5.

(Continued on page 82)

Science for Electroplaters

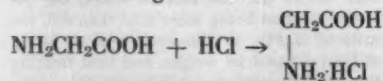
41. AMINO ACIDS

By L. Serola

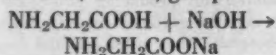
THE characteristic of this type of organic acid is the presence of the amino (NH_2) group in place of a hydrogen from a group attached to the carboxyl (COOH) group. For example, acetic acid (CH_3COOH) will become aminoacetic acid when the hydrogen is replaced (substituted) by the amino group: $\text{NH}_2\text{CH}_2\text{COOH}$. This acid, the simplest amino acid, is also called glycocoll or glycine. The different types of substituted acetic acids considered so far may be summarized as follows: Chloroacetic or halogen acetic acid (ClCH_2COOH), hydroxyacetic acid (HOCH_2COOH), amino acetic acid ($\text{NH}_2\text{CH}_2\text{COOH}$).

For the higher molecular weight acids the nomenclature for naming the acids is similar to that for the halogen and hydroxyacid; thus, amino propionic acid and aminobutyric acid. Aminoacetic acid may be prepared by treating a halogen substituted acid with ammonia: $\text{ClCH}_2\text{COOH} + \text{NH}_3 \rightarrow \text{NH}_2\text{CH}_2\text{COOH} + \text{HCl}$.

Since both the NH_2 and COOH groups are present in an amino acid, the properties of both a base and an acid are indicated. When an amino acid such as glycine is treated with hydrochloric acid, the reaction occurs with the amino (basic) group and proceeds in the following manner:



(glycine hydrochloride). The addition of sodium hydroxide, however, to the amino acid, glycine, will yield sodium glycinate as a result of the reaction with the acid, COOH , group:



G. Fuseya and K. Murata reported that the results of experiments conducted with copper sulfate and silver nitrate

baths indicate that copper and silver form complex ions with glycine as well as with tartaric acid ($\text{H}_2\text{C}_4\text{H}_4\text{O}_6$) and metaphosphoric acid (HPO_3). Amino acids and oxy-acids, it was reported, give complex copper or silver cations. The presence of glycine in the copper deposit was confirmed by dissolving the deposit in dilute sulfuric acid electrolytically, and developing the blue color reaction by the addition of phenol and sodium hypochlorite. One of the effects of the increase in weight of the deposit was the reduction in crystal size. Experiments with silver deposition showed that the amino acid, glycine, does not enter into the deposit when

added in small quantities, whereas tartaric acid, the hydroxyacid, will appear in the deposit even if present in small amounts. The authors noted that silver ions are less likely to form complex ions than are the copper ions.

J. T. Barker noted that experimental results indicate that the copper ion in a copper sulfate solution decreases progressively with increased additions of glycine. This fact led Barker to assume that the copper (cupric) ion will be converted almost entirely to a cupri-glycine complex ion or neutral compound with a large excess of glycine, a view substantiated by the accompanying data. (Table 1.)

TABLE 1

Molar ratio of glycine to CuSO_4	Relative concentration of Cu^{++} ion
0	100
1	48
2	19
5	5

The author considers the relationship of the glycine molecule to the copper atom, in the complex copper glycine sulfates, similar in nature to that of the ammonia molecules in the complex copper ammonium sulfates; that is, 4

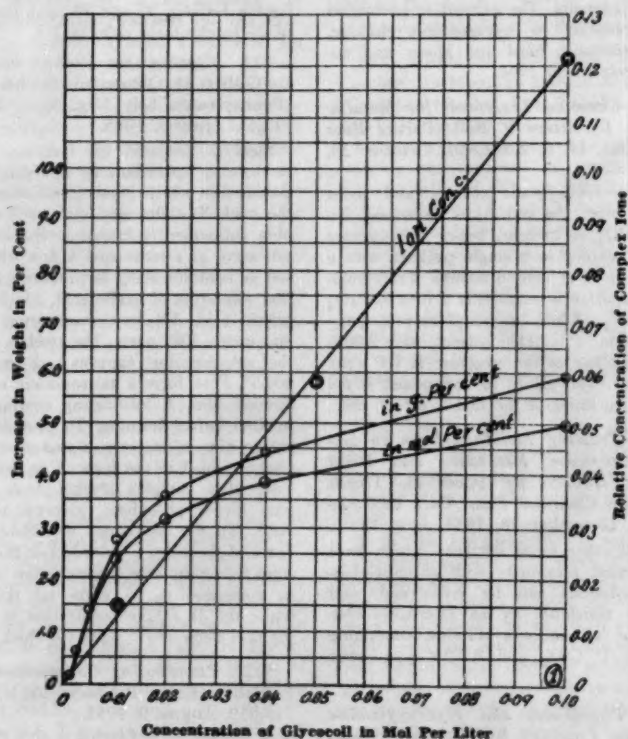


Fig. 168

molecules of glycine (or ammonia) to 1 atom of copper. The glycine or ammonia molecules are believed to be related to the copper atom, through the subordinate or secondary valences of the nitrogen atom.

Glycine

G. Fuseya and M. Magano have reported the effect on the electrodeposit from a copper sulfate solution based on the following changes: variations in the quantity of glycine added; changes in temperature, current density, and acidity. Results indicated that the proportion of increase in copper deposit becomes less, the greater the quantity of glycine added. An increase in weight of 3.2 percent of copper results when 0.02 mole-percent of glycine is added, but only a 5 percent increase in weight is attained when the concentration of glycine is increased to 0.1 mole/l. With 0.01 mole/l. the relative concentration of complex ions measured was 0.015 and, with 0.05 mole/, the relative concentration of complex ions measured was 0.058 (Fig. 168).

Increasing the temperature reduced the amount of glycine deposited (Fig. 169). The same effect was observed with increase in concentration of sulfuric acid. A comparison is made with a blank run (without the addition of glycine), in which negligible changes in the weight of the deposit occurred at the temperature and current density used in the main experiment. This is shown in Fig. 170.

An increase in current density, however, showed a greater amount of glyco-coll entering the deposit, but the rate of increase becomes smaller beyond a certain density (Fig. 171).

Sulfonic Acids

Sulfonic acids, or the salts (sulfonates) of such acids, represent a class of compounds that is finding increasing use as additives, such as wetting agents, brighteners, or detergents, in electroplating solutions. Structurally,

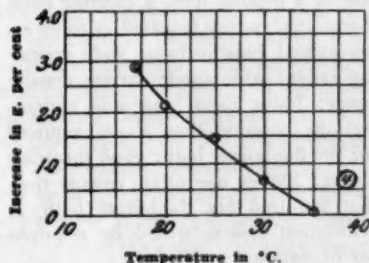


Fig. 169

such compounds resemble sulfuric acid (HOSO_2OH) with a hydrocarbon radical (R) substitution effecting a sulfur to carbon bond, such as $\text{R-SO}_2\text{OH}$.

The most prominent chemical properties of this group of organic compounds are attributed to the functional group containing sulfur. The sulfonic acids are classified as derivatives of the aliphatic or open chain compounds, with methane (CH_4) as the basic paraffin, and the aromatic or closed compounds, with benzene (C_6H_6) as the basic compound for this group. The paraffins are generally known as *alkanes* and the radical is referred to as the alkyl group. The letter "R" is commonly used to represent the alkyl group.

The term aromatic was introduced because of the pleasant aroma associated with many of these naturally occurring substances. Some common ex-

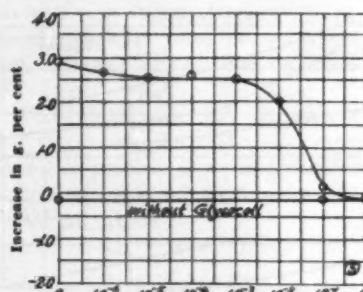


Fig. 170

amples are: turpentine oil, chiefly the terpene, pinene ($\text{C}_{10}\text{H}_{16}$); oil of bitter almonds or benzaldehyde ($\text{C}_6\text{H}_5\text{CHO}$); oil of wintergreen or methyl salicylate ($\text{HOC}_6\text{H}_4\text{COOCH}_3$). The distinction, however, between the two classes of compounds is not clearly defined by the characteristic of aroma; hence the designation of open-chain compound as aliphatic compounds and closed chain or ring (cyclic) formulas as aromatic compounds. Monovalent radicals of aromatic hydrocarbons, those in which the union is with a carbon atom of the ring, are known as aryl radicals.

Benzene Structure

Although the formula for benzene (C_6H_6) would indicate properties and structure resembling unsaturated compounds of the simple alkenes and alkynes such as ethylene (C_2H_4) and acetylene (C_2H_2) with double and triple bonds, its properties compare more closely with those of a saturated hydrocarbon.

The chief reactions, for example, are

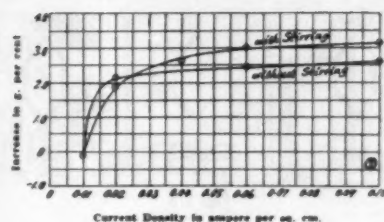


Fig. 171. Effect of Current Density.

substitutions rather than additions. The addition to benzene of six chlorine or hydrogen atoms, suggests the presence of double bonds. The symmetrical nature of the benzene molecule is demonstrated by the fact that only one monosubstitution product, bromobenzene ($\text{C}_6\text{H}_5\text{Br}$), is known. Further, an acceptable explanation of the structure of the molecule should allow for the three known isomeric (dibromobenzene) substitution products. The facts indicated by isomerism, hydrogenation, and crystal structure studies, suggest a ring structure containing six equivalent carbon atoms, with each carbon atom carrying a hydrogen, an arrangement proposed by Kekulé in 1865 and

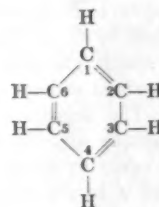


Fig. 172

generally accepted today. To satisfy the valence of four for each carbon atom the alternate double and single bond concept was included. Thus the structural formula for the benzene molecule is represented in Fig. 172.

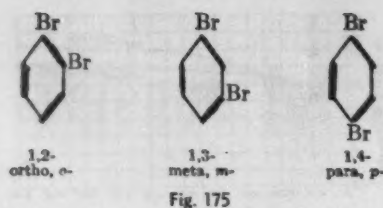
The high stability and other properties of benzene are attributed to the possibility of resonance of the valence electrons of the ring between the two principal Kekulé structures, represented by the two formulas in Fig. 173. The hexagon in Fig. 173 is the conventional method of representing a simplified form of the benzene molecule. The benzene molecule is also represented with alternate heavy lines in the hexagon indicating double lines, as shown in Fig. 174.



Fig. 173



Fig. 174



The cyclic structural formula serves as a satisfactory method of representing the three known isomeric disubstitution products. Thus, replacement of hydrogen in the 1, 2 position, or replacement in any similar adjacent pair of hydrogens, will yield an ortho (o) compound; substitution in the 1, 3 position or a related alternate group will give a meta (m) compound; and substitution in the 1, 4 or 2, 5 or 3, 6 positions results in the formation of a para (p) compound. The o-, m- and p-dibromo benzene isomers, as examples, are represented by the structural formula in Fig. 175.

Alkane Sulfonic Acid Bath

Copper plating in alkane sulfonic acid baths at varying current densities ranging from 60 to 1,000 amp./ft.² has been described by C. L. Faust and associates. A semibright plate, it is reported, is obtained without using addition agents. The deposit is smoother than from simple organic salts; it is color-buffed easily by wheel or electrolytically; and a bright nickel deposit over the semibright metal yields good color. A mixture of the alkane sulfonic acids of methane (CH₃SO₃H), ethane (C₂H₅SO₃H) and propane (C₃H₇SO₃H) was used. The alkane sulfonic acids are strong acids and react as mono-bas-

ic acids in the formation of metal salts, a class of compounds which are very soluble in water. The solubility at 20° C. is 68 grams in 100 cc. of water for the barium salt of methane sulfonic acid, and 81 grams in 100 cc. of water for the barium salt of ethane sulfonic. The solubility for the corresponding lead salts is given as 144 grams per 100 cc. water and 206 grams per 100 cc. water respectively.

The copper alkane sulfonic acid bath contained 2 copper anodes and a soft brass cathode. The cleaning cycle for the panel included degreasing in trichloroethylene, hot alkaline cleaner, and an ammonium chloride-hydrochloric acid dip (150 g./l. NH₄Cl, 42 cc./l. conc. HCl) for 15 minutes at 60°F. The composition and operating characteristics of three copper alkane sulfonic baths are given in Table 2. The average properties of the three

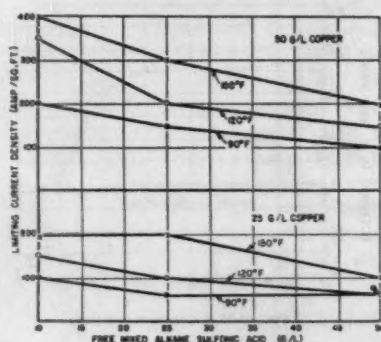


Fig. 176

baths included: sp. gr. 1.35; normality 12.08; 92.7 percent mixed alkane sulfonic acid (average molecular weight, 113); 3.2% H₂SO₄; 4.1 % water. The pH of a 1% solution is about 1.15.

TABLE 2

Bath Composition and Operating Characteristics of Copper Alkanesulfonate Baths

Composition g/l	Bath No.		
	25-10	50-10	100-10
Basic cupric carbonate (55.5% Cu), g/l.....	45.1	90.1	180.2
Copper (as metal), g/l.....	25	50	100
Free alkane sulfonic acid, g/l.....	5-10	5-10	5-10
Operating Characteristics*			
Limiting current density† at 120° F, asf.....	130	350	700
Practical current density range at 120° F, asf....	20-100	100-250	250-600
Limiting current density† at 150° F, asf.....	200	400	1200
Practical current density range at 150° F, asf....	20-150	100-300	500-800
Cell voltage at 150° F.....	0.5-4.0	2.5-6.5	8.5-12.0
Ratio anode to cathode area.....	1:1	2:1	4:1

*With work rod movement = 2-inch stroke, 32 cycles/min.

†Limiting current density is defined as the maximum asf which gives satisfactory 0.001 inch plate

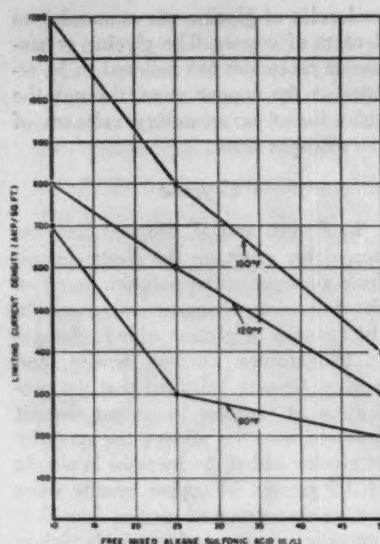


Fig. 177

Deposits of about 0.001" thickness were made at varying current densities at temperatures of 90°, 120°, 150°F. Limiting current density was determined by the degree at which burning of plate was observed. Results for the three baths are shown graphically in Fig. 176 for the 25 g./l. and 50 g./l. copper baths and Fig. 177 for the 100 g./l. bath. Bath 25-10 gave smooth, pink and mat plates, with finer grain appearing at current densities higher than 100 amp./ft.² The deposits from the 50-10 bath were smooth and fine grained (150 amp./ft.²) and easily buffed, whereas the 100-10 bath required careful control of temperature and current density to obtain a lustrous easily buffed plate. Bright nickel deposited on the lustrous plate gave good color. For die castings, where ductility is not a critical factor, current densities ranging from 60-500 amp./ft.² are recommended at 90°F.

Up to the thickness of 0.003-5", grain size of the deposits obtained from the alkane sulfonic acid (sulfonate), it was found, is smaller than that resulting from the copper sulfate or fluoborate bath and compares with the grain size of a deposit from a cyanide bath. Additional factors revealed by these experimental runs include: wide operating range; wide anode current density range; lower metal and acid concentrations possible than those required for the fluoborate bath; good throwing power; higher operating voltage than that required for fluoborate bath. A ventilation system would be required for operation.

(To be continued)

SHOP PROBLEMS

BARREL FINISHING — POLISHING AND BUFFING
CLEANING — ANODIZING — ELECTROPLATING
RUSTPROOFING — LACQUERING AND ENAMELING



METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Danger of Sparking

Question: We require some construction work to be done in our lacquer finishing room while the finishing operations are in process. Since we will be using steel hammers and wrenches for the work, we would like to know if you have any suggestions as to how we may minimize the danger of sparking which may cause fires.

J. G.

Answer: Special care should be used to see that flammable solvents are not used near areas where the construction work is being done. If you are unable to use non-sparking tools because of their relatively low strength characteristics, heavy copper or nickel plated tools will serve a similar function.

Coating Interior of Aluminum Cans

Question: We are interested in finding an organic coating with as high an infrared absorptivity as possible. We wish to use it to coat the interior of aluminum cases that house electronic equipment so as to dissipate the heat produced in operation. We would appreciate receiving from you any suggestions you might have as to a material.

W. B. H.

Answer: Use an optical black lacquer having a thickness of 0.0002" maximum. Our reasoning for this is: 1) optical black coatings, having low transmissivities, will retain electromagnetic radiations (especially if the coating formulation is specifically designed for the wave lengths of infrared which you are concerned with, since reflection will be at a minimum); 2) thin films will permit more rapid heat transfer, thereby providing the necessary thermal dissipation.

Power Supply

Question: I would like to set up hard chrome plating using two 9 volt, 1500 amp. rectifiers. However, only single phase electric service is available. A phase changer or converter has been suggested to change the single phase electric to three phase. Would such a changer or converter be practical?

Would appreciate any suggestions that you could offer that would overcome this problem if a phase changer or converter was not used or was not considered practical.

W. A. V.

Answer: It will probably be more practical to trade in the rectifiers on a motor-generator set, than to install a converter. Before deciding on either possibility you should check with the local utility to see if the power feeder serving your plant is of sufficient capacity, since the additional load will be about 30 KW. If additional transmission facilities will have to be paid for, it may be cheaper to purchase a war-surplus engine-driven a.c. generator to supply the rectifiers.

Chromic Acid Anodizing

Question: We have a 350-gallon chromic acid anodize bath that has, for the third time in the last 12 months, become inoperative almost overnight. Under normal operation, we have had little trouble meeting the specifications of MIL-A-8625-A which requires a coating weight of 200 mg. per sq. ft. However, at the present time, as has happened twice before, we are able to obtain a coating weight of only about 150 mg. per sq. ft. This change has seemed to appear suddenly, but we have been unable to detect any change in the chemical composition of the so-

lution. In the past, the process has rectified itself without addition or chemical adjustment in a couple of weeks' use on work which doesn't need to meet the MIL spec.

There seem to be at least two potential sources to this problem, but we have been unable to pin down the exact cause. First the work is cleaned in a non-silicated, non-etch alkaline cleaner, at 6 oz./gal. The work is then rinsed in warm water with air agitation. After rinsing, the work is transferred directly to the anodize tank without a nitric acid dip. Could the carry-over of the cleaner cause this trouble? Secondly, on each occasion that this problem has arisen, we have found that our water supply, for a short time prior to the trouble, has been excessively high in chlorine. Could the residual chlorine in the makeup water cause this problem? Is there any practical method of analysis for this chlorine in an anodizing solution?

We maintain a pH of 0.70 as closely as possible and the present analysis shows a pH of 0.72, free CrO_3 of 25 gpl, and a total CrO_3 of 84 gpl.

M. Y.

Answer: Drag-in of cleaner would result in neutralization of some of the free chromic acid and an increase in pH, which would be corrected by additions of chromic acid.

Assuming electrical conditions are satisfactory, the thin oxide film is usually due to chlorides or to alloying metals, such as copper in 24ST alloy which, if segregated, will tend to slow down film formation. If you can obtain the proper film on 2S or 3S alloy, but not on the copper-aluminum alloys, it would indicate that the metal is at fault. If you have trouble with 2S, it is suggested that you check on the chlorine content, using the silver nitrate precipitation method in acidified solution.

Plating on Tin

Question: We are experiencing some difficulty in plating articles fabricated of tin plates. We wish to give a nickel-chromium finish. The sequence of op-

eration has been as follows: a) degreasing, b) cathodic alkaline cleaners with or without anodic cleaners, c) acid or cyanide dip, d) strike in cyanide copper, and e) bright nickel and chromium plating.

The adhesion of the deposit is poor and on slight bending chips off from the tin coating. We would like to have your comments and recommendations as soon as possible and would appreciate any information that you can give us as to how to solve this problem.

G. E. E.

Answer: Many methods for plating on tin have been suggested and the following has been claimed to show good adhesion even after one year:

1. Degrease and cathodic clean in 5% soda ash solution for 2-5 minutes at 60-65 deg. C., and 50 amp./sq. ft.
2. Rinse in hot water.
3. Dip in 10% by volume fluoboric acid for 15 seconds.
4. Rinse and nickel plate in fluoborate nickel solution:

Nickel fluoborate 300 g./L.
Boric acid _____ 30 "
Temperature _____ 44 deg. C.
pH _____ 2.7
Current density — 10 amp./sq. ft.

Electropolishing Tungsten

Question: We have a problem dealing with chemical polishing or brightening of tungsten. Do you have any information on this subject?

G. W. S.

Answer: We find no data on methods for chemically polishing tungsten. However, this metal can be electropolished. Suitable solutions are 10% caustic soda solution at room temperature and 30-60 amp./ft.² or 16% trisodium phosphate at 100° F. and 360 amp./ft.²

Copper Sulfate Test for Stainless Steel

Question: Could you advise us the proper solution of copper sulfate to test passivated surfaces of stainless steel?

J. A. S.

Answer: Federal specification GG-1-526a describes the following solution:

Copper sulfate _____ 4.0 grams
Sulfuric acid _____ 10.0 mil.
Water _____ 90.0 "

Apply drops at 3 spots and let stand 6 minutes, then wipe off. Pieces should not show any copper deposit. The part may also be immersed in the solution.

Silver Plating Bearings

Question: We would appreciate any information you can supply us with on plating of the ID of bearings with silver.

C. L. P.

Answer: There is no general procedure for silver plating bearings, some platers using insoluble anodes and others using bagged stainless steel mesh

anodes filled with silver shot. However, the high-speed silver plating solution described in the METAL FINISHING GUIDEBOOK is suitable for both methods.

Of most importance in applying the heavy deposits required, is the necessity for good filtration and agitation of the solution. In some cases, the bearings are stacked to form a tube, through which the filtered solution is pumped at high speed.

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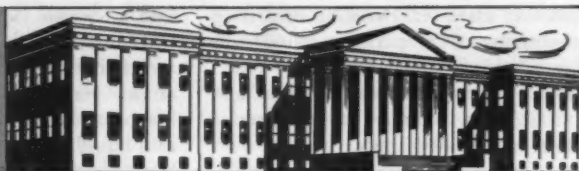
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Patents

RECENTLY GRANTED PATENTS
IN THE METAL FINISHING FIELD



Chromizing Process

*U. S. Patent 2,825,658. March 4, 1958.
G. A. Samuel, assignor to Metal Diffusions, Inc.*

The method of chromizing, which comprises treating steel having a carbon content of 0.35 percent or less with exclusion of air at a temperature of from 1650 to 1950°F. for a time of at least three hours with a source of finely divided chromium and from 0.06 to 0.26 percent on the weight of the chromium of ammonium bromide.

Polytetrafluoroethylene Coating

*U. S. Patent 2,825,664. March 4, 1958.
J. R. Huntsberger, assignor to E. I. du Pont de Nemours and Co.*

An aqueous coating composition comprising water, colloidal polytetrafluoroethylene, and 10%-85% by weight based on the polytetrafluoroethylene of water-soluble alkali metal silicate together with colloidal silica, the ratio of said silicate to said silica being between 25:75 and 90:10 by weight.

Antimony-Tin Alloy Bath

*U. S. Patent 2,825,683. March 4, 1958.
F. A. Lowenheim and H. B. Forman, assignors to Metal & Thermi Corp.*

Method of producing tin-antimony alloy plate containing about 0.2 to 1% of antimony, said plate being resistant to transformation of the tin, which comprises electrodepositing said plate on an article cathode from a bath solution containing about 0.25 to about 0.5 mol per liter of sodium stannate, about 0.2 to about 0.6 mol per liter of free sodium hydroxide, and an amount of sodium pyroantimonate sufficient to saturate the solution and to provide an undissolved excess of sodium pyroantimonate, electrodepositing said tin at a temperature in the range of about 60°C. to substantially the boiling point of the solution and at a current density in the range of about 5 to 30 amperes per square foot.

Bright Copper Bath

*U. S. Patent 2,825,684. March 4, 1958.
C. J. Wernlund, assignor to E. I. du Pont de Nemours and Co.*

An aqueous bath for electrodepositing bright copper containing copper cyanide and a dual metallic brightening agent comprising about 0.612-6.12 g./l. of metallic selenium supplied as a member of the group consisting of the selenium oxides, selenous and selenic acids and the alkali metal salts of said acids, and a soluble compound of a metal taken from the class consisting of cadmium in an amount from about 0.007 to 7 g./l., bismuth in an amount from about 0.002 to 0.05 g./l., and silver in an amount from about 0.008 to 1.62 g./l.

Aluminum Conversion Coating

*U. S. Patent 2,825,697. March 4, 1958.
J. A. Carroll and N. J. Newhard, assignors to American Chemical Paint Co.*

The method of increasing the corrosion resistance of an aluminum surface without changing its appearance which consists in treating the surface with an aqueous acid solution consisting essentially of hexavalent chromium and a soluble complex fluorine-bearing compound, the amount of hexavalent chromium being from 0.4 gram to 4 grams per liter calculated as CrO_3 and the amount of fluorine-bearing compound being from 0.1 gram to 1.0 gram per liter calculated as fluorine and the pH of the solution being from 2.0 to 4.0.

Coating Composition

*U. S. Patent 2,825,706. March 4, 1958.
P. F. Sanders, assignor to E. I. du Pont de Nemours and Co.*

A liquid coating composition comprising colloidal tetrafluoroethylene resin, 5%-100% of heat-reactive phenol aldehyde resin, and up to 100% of other organic film-forming material, in a liquid medium comprising water.

Coating Composition

*U. S. Patent 2,825,709. March 4, 1958.
R. H. Sturm, assignor to Cosmocord Plastics Ltd.*

The method of manufacture of a coating composition suitable for application without heat which comprises compounding polyethylene and polyisobutylene at a temperature of between 120°C. and 130°C., allowing the resultant compound to cool and solidify, breaking the cooled compound into chips, grinding the chips in a solvent in quantity sufficient to give a liquid composition containing not more than 30 percent of solids at a temperature of between 60°C. and 80°C. until the chips are dissolved, and continuing the grinding while reducing the temperature of the solution to room temperature until the mean size of the compound particles is less than 0.6 micron.

Paint Roller Scraper

U. S. Patent 2,825,916. March 11, 1958. A. J. Basala, Jr.

A paint roller cleaning device comprising: a single length of flat strip material including a U-shaped portion medially between the opposite ends of said length of material, and a pair of elongated handles having the rear ends thereof integral with the opposite ends of said U-shaped portion.

Porcelain Repair

U. S. Patent 2,826,508. March 11, 1958. J. E. Giles.

A process for repairing damaged porcelain comprising applying an undercoating onto the damaged portion of the porcelain until the damaged surface is built up to the desired shape, allowing said undercoating to harden, applying a glaze outer coating thereon, and baking said glaze outer coating, said undercoating consisting essentially of a mixture of 67-75% whiting, 5.25-12.25% pigment, 2.2-7% melamine resin and 8.6-25.7% alkyd resin,

and said glaze outer coating consisting essentially of a mixture of 65-75% alkyd baking enamel, 15.35% of a mixture of xylol and a melamine resin, and 1-10% of a mixture of a melamine resin and an alkyd resin.

Paint Brush Wiper

U. S. Patent 2,826,331. March 11, 1958. P. H. Petite.

A brush wiper for use with paint cans comprising a pair of straight wire-like members secured together in crossed relation at right angles to each other and at a point adjacent an end of each wire-like member, and a straight wire-like spreader connecting the free ends of the crossed ends of said wire-like members and serving to hold said free ends against movement toward and away from each other.

Conversion Coating

U. S. Patent 2,826,517. March 11, 1958. D. E. Miller, assignor to Kelite Products, Inc.

A process of phosphating metals which comprises, contacting the metal with a phosphatizing solution comprising zinc, free phosphoric acid and sodium acid pyrophosphate, the initial ratio of zinc to free phosphoric acid being in the proportion of from 1 part ZnO to 3 to 4.7 parts of H_3PO_4 , the zinc being present in an amount equivalent to 0.026 to 2.5 grams per liter, and the sodium acid pyrophosphate being present in amounts from 1 to 25 grams per liter said ingredients in the solution reacting to form zinc pyrophosphate and zinc acid phosphate, said solution being maintained at a temperature of from about 60°C. to about 82°C.

Electroformed Wave Guides

U. S. Patent 2,826,524. March 11, 1958. R. D. Molloy, assignor to Textron, Inc.

The method of forming a wave-transmitting element, comprising the steps of electroplating a mandrel with a conductive coat, covering the conductively coated mandrel with a fibrous material, securing the fibrous material about the electroplated surface with an epoxy resin, and removing the mandrel.

Electrostatic Coating

U. S. Patent 2,826,513. March 11, 1958. A. Blanchard.

A method of transporting onto a sur-

face a viscous liquid having a dielectric constant of the order of 1 to 5 and a resistivity not less than 1.44×10^6 ohms, consisting in introducing a homogeneous and continuous body of said liquid into an insulating enclosure having a discharge orifice directed toward said surface, applying to the liquid in said enclosure a pressure sufficient to cause said liquid to flow to said orifice but insufficient to produce the flow of a continuous stream of liquid from said orifice, establishing an electric field having a potential of 10,000 to 100,000 volts between a first electrode which is associated with said enclosure and in contact with said body of liquid and a second electrode which is associated with said surface, said first electrode being spaced rearwardly of said orifice in a direction away from said surface a distance greater than the arcing distance of the voltage applied between said electrodes, said electric field being of a magnitude to force a jet of liquid out of said orifice toward said surface and dispersing said jet into a spray before the liquid reaches said surface, said liquid being transported from said orifice to said surface substantially solely by said electric field.

Aluminum Paint

U. S. Patent 2,827,388. March 18, 1958. J. P. Mayer and M. D. Wright, assignors to The Glidden Co.

An improved aluminum dipping enamel composed essentially of: (A) an organic solvent solution of film-forming material composed essentially of alkali-metal-catalyzed, solvent-polymerized, hydrocarbon drying oil selected from the class consisting of C_4 - C_6 conjugated diolefin homopolymers, copolymers composed essentially of 50-90% C_4 - C_6 conjugated diolefins and 50-10% styrene, and mixtures thereof; and (B) leafing aluminum pigment dispersed in said vehicle in amounts at least sufficient to provide hiding in an applied film thereof.

Continuous Strip Cleaning

U. S. Patent 2,826,539. March 11, 1958. J. B. Murland, Jr., assignor to Allegheny Ludlum Steel Corp.

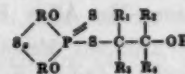
In the method of cleaning oxides from metal strip formed from titanium, titanium base alloy, zirconium and zirconium base alloy, the steps comprising, immersing and passing the metal strip through a heated caustic bath in an iron-base tank to effect a reaction

between the caustic and the oxides, maintaining the metal strip submerged in the heated caustic bath by means of a rotatable hold-down iron-base roll disposed in engagement therewith and having a portion thereof immersed in the heated caustic bath, the iron-base roll being electrically insulated from the iron-base tank, the metal strip in the heated caustic bath normally being at a potential different from that of the iron-base roll and iron-base tank, connecting the iron-base roll and iron-base tank to the negative terminal and the positive terminal, respectively, of a supply of current to effect a flow of current therebetween through the heated caustic bath to impart to the iron-base roll a polarity different from that of the iron-base tank whereby the potential between the iron-base tank and the iron-base roll is substantially equal to the normal potential between the iron-base tank and the metal strip to thereby substantially eliminate any difference in potential between the iron-base roll and the metal strip and prevent electrolytic pitting of the metal strip as the caustic reacts with the oxides of the strip in the heated caustic bath.

Corrosion Preventive

U. S. Patent 2,826,550. March 11, 1958. J. P. McDermott, assignor to Esso Research and Engineering Co.

A mineral oil containing dissolved therein a corrosion inhibiting amount of an oil-soluble compound of the formula



wherein R is an aromatic radical having an alkyl group containing 4 to 24 carbon atoms; wherein x is an integer of from 1 to 2; wherein one of the symbols R_1 , R_2 , R_3 and R_4 represents a radical selected from the group consisting of a hydrogen atom, an aliphatic hydrocarbon radical containing from 1 to 4 carbon atoms, and a phenyl radical; and wherein the others of said symbols are hydrogen atoms.

Spray Guns

U. S. Patent 2,827,330. March 18, 1958. J. W. Baur, assignor to Binks Mfg. Co.

A spray gun structure which comprises a body portion, a handle therefor, a spray head portion for the gun

and a spray nozzle part where the coating material handled in the gun is sprayed, the combination therewith of heat insulating material disposed between the body portion of the gun and the spray head portion of the gun.

Centrifugal Cleaning Apparatus For Paint Applicators

U. S. Patent 2,826,826. March 18, 1958. O. Boehm.

Centrifugal cleaning apparatus for paint applicators.

Spraying Hollow Articles

U. S. Patent 2,827,009. March 18, 1958. E. O. Norris.

Apparatus for spraying a spray material onto the inner peripheral surface of a hollow cylindrical member.

ABSTRACTS

Corrosion Behaviour of Cadmium and Nickel Coatings under Tropical Conditions

H. Roggendorf: *Metallwarenind. und Galvanotechnik*, 48, No. 10, 449.

The corrosion protective value of nickel coatings depends primarily on the thickness. Nickel coatings up to 6 microns are completely ineffective for exterior exposure in temperate climates. For office machinery equipment and the like, in interior exposure use, 18 microns of copper and nickel may be regarded as providing satisfactory protection.

Nickel coatings of 25 - 30 microns, without intermediate copper, are necessary for tropical conditions. It is only with coatings of this thickness that the necessary freedom from porosity is ensured. The protective value of the nickel coating under tropical conditions is greatly reduced by using an intermediate copper as a substitute for some of the nickel. However, greater protection is afforded if 0.5 micron of chromium is given to the copper-nickel coatings.

A cadmium sub-plate will have only a small influence on the corrosion-protective value of the nickel plate. For ware which is exposed to interior atmospheres, 18 microns of copper and nickel will correspond to the protective value of about 10 microns of cadmium. Cadmium plating to stand up to external exposure under tropical condi-

tions require coating thicknesses of 20 - 24 microns.

Passivated zinc will generally be found superior to cadmium in temperate zones; passivated zinc is not suitable, however, to give rust protection to iron and steel under tropical conditions. The corrosion protective value of cadmium coatings is often over-rated but the metal is of value as a rust-protective coating for iron and steel under tropical conditions.

Wear Resistance of Hard Chromium Plated Drop-Forge Dies

K. Lange, H. Meinert and H. Arend; *Forschung Bericht*, Nordrh-Westf. No. 286.

Tests have previously been made in German and foreign drop forging plants, with hard chromium plated forging dies. Sometimes very good results have been obtained but, at other times, the results have been negative. Consequently hard chromium plating of these dies has not become a generally adopted practice. The German Drop Forgers Research Association has accordingly, conducted research on this important technical matter. The objective of this comprehensive research program was to establish the possibilities and limitations of hard chromium plating practice with drop forging dies as well as to ascertain the most favorable plating and operating conditions.

The report covers a description of the theory of chromium plating practice; calculation of the current efficiency and the throwing power; gas content of the deposit; characteristics of the coating; and heat treatment of plated parts and various other pertinent technical data.

It was found that hard chromium plated drop forging dies have about two to three times the production life compared with the non-plated parts. The following detailed points were instanced.

1. The wear on the die is small, even at the most exposed positions. The ridge (burr) remains thin, so that deburring presents no difficulties.

2. Hard chromium plated drop forging dies have no tendency to sticking and it is easy to eject the finished forging. Consequently, a more rapid forging schedule is possible and this, in turn, has the result of giving an increased output from the drop forging hammer.

3. The drop forging costs per forged

part, become lower. The die making department is considerably relieved.

4. The lower wear which is obtained on the forging dies gives, as a result, a good surface characteristic and dimensional precision to the forged part.

These advantages can, however, be achieved only with thorough pretreatment and prehandling of the surfaces. Detailed specifications in this direction are given.

Electrolytic Pickling of Stainless Steels

By O. P. Kraemer; *Metallwarenind. und Galvanotechnik*, 48 No. 4, 149.

Electrolytic pickling of stainless steel can be classified into anodic and cathodic processes, current reversal treatment, alternating current treatment, and the medial conductor principle.

The pickling action of the acids is enhanced with the anodic pickling treatment. Thus, metal is not only dissolved chemically by the acid attack, but also electrochemically. A certain brightening effect can be obtained with high current densities. Some electrolytic compositions can approach the electropolishing baths.

With cathodic pickling, the forcing-off action of the hydrogen serves to enhance the pickling effect of the acid. The hydrogen which is formed at the cathode, loosens the scale and pushes it off in pieces. Hydrogen embrittlement must be guarded against with cathodic pickling.

Pickling with periodic current reversal embodies the advantages of both anodic and cathodic pickling. With correct bath operating conditions, there is neither excessive metal removal through overpickling, nor pickling embrittlement through hydrogen adsorption. The same holds good for pickling with alternating current.

With the medial conductor pickling process, which can be conducted either with current reversal or with alternating current, the ware to be pickled is not placed in direct circuit with the current flow. This is a particular advantage when large parts are being pickled. The electrodes are arranged at both sides of the pickling bath. The ware to be pickled is then racked between the two electrodes. The current flows from one electrode to the ware, then through this to the other electrode. If only direct current is being used in the bath, then the side of the pickled ware adjoining the anode will act as cathode and the other side adjoining

the cathode, as anode. So as to pickle both sides of the ware uniformly anodic and cathodically, the current flow, accordingly, must be reversed at regular periodic intervals or else alternating current should be employed.

Greville Process of Hot Dip Tinning

Metallwareind. und Galvanotechnik, 48, No. 9, 65.

Details are given of the Greville process for hot-dip tinning, which has been developed mainly for processing parts for the radio industry. With the process, tin coatings of a specified thickness can be produced (up to 0.002 mm.). High surface quality and uniform tinning at all points, which are two characteristics of this process, necessitate maximum cleanliness of the parts, before tinning. The components are first degreased in caustic soda or in trichlorethylene. After this, there follows a pickle in 50% hydrochloric acid at 70° C. (Dip time — 5 minutes to 1 hour.)

Monel baskets are used exclusively. Outstandingly satisfactory results have been obtained under the fairly severe working conditions. Some pickling baskets are still in operation which were installed in 1940. The fact should be considered that these baskets on the average, are immersed daily for a total of about 4 hours in the pickling bath.

After pickling, the parts are stored in a 2% hydrochloric acid solution, so that the surface remains clean. These storage containers are also made of Monel. Zinc-ammonium chloride is used in the process as the fluxing agent.

Correct Formulation of Buffing and Polishing Compositions

Metallwareind. und Galvanotechnik, 48, No. 9, 404.

There are a great many abrasives which can be employed, according to the requirements. Considerable practical experience is required in the case of calcined alumina, for example, to select those types which are best suited for the corresponding objective. Variations are available, providing a strong cutting action, up to the finest polishing action. The polishing composition must be so formulated that, with a suitable selection of the grain sizes of the aluminas used, a uniform surface is obtained on the part being processed, without too much or too little being removed from the surface. Many types

of aluminum oxide require a certain pretreatment before their employment, so that the grain sizes conform to requirements without the actual structure of the grain being destroyed. Only precise supervision of production and continuous chemical control can ensure this.

New advances have also been made as regards the grease binders used for these polishing pastes. Stearin and its oils, tallow, and paraffin, are not the only materials which can be used today. Products have been developed as bonding media which allow complete conformity with the mineral used in the paste, as regards consistency, melting point, chemical characteristics, etc.

A complication is the variation in working conditions from one polishing department to another in different plants. Polishing and buffing wheels differ in type and size and wheel speeds will be different. Anomalies will be encountered also in the material to be polished, differing from the material in another plant. Yet the same finished products may be produced in both plants. Special consideration may also be required as regards the cleaning characteristics.

This all adds up to the fact that the polishing composition has to be formulated according to the actual working conditions. There can be no question as to a universal composition. Care is needed also in other respects; for example, it is not always the composition which gives the most rapid results at first glance, which is necessarily the correct one.

The experience of a technician of a polishing composition manufacturer is the best criterion for resolving problems of this nature. This experience can decide the most suitable polishing composition for any particular purpose, and the one which will provide the highest output. Such experience also decides whether preference should be given to water-soluble pastes or whether polishing emulsions should be used.

PHOSPHATING TREATMENTS (Concluded from page 73)

518. *Composition and Process for Treating Metal Surfaces*. By James W. Condon (Westinghouse Electric Corp.). U. S. 2,743,205. April 24, 1956.

An aqueous solution for treating metal surfaces in order to render them more active in the subsequent formation of phosphate coating thereon the components of said solution are: from 0.001 to 0.6% by

weight of lithium; .0004% by weight of PO_4 present as an alkali orthophosphate, being 1 to 125 parts lithium for each 50 parts by weight of PO_4 , the lithium compound and alkali orthophosphate having been previously dissolved in water and evaporated to dryness.

519. *Method of Simultaneously Phosphating and Cleaning Metal Surfaces and Composition Therefor*. By Andrew Nicholson and Cyril F. Wilkinson (Parker Rust Proof Co.). U. S. 2,744,555. May 8, 1956.

A process for simultaneously cleaning and producing a phosphate coating on the surfaces of the group consisting of iron and zinc and their alloys. This consists of (1) applying to the surface an aqueous solution of acid phosphate of an alkali metal in the presence of an accelerator having an effect on the coating equal to 0.5 to 4% perchlorate, 1 to 10% of a hydrocarbon solvent and a non-ionic oil in water emulsifying agent having 3 to 25 polyethylene groups of said solvent. The pH should be maintained from 3.5 to 5.8, and the coated surface should be rinsed with a dilute solution of chromic acid.

520. *Method of Treating Articles Requiring Annealing*. By Thomas C. Burnham (Rohr Aircraft Corp.). U. S. 2,748,037. May 29, 1956.

The method of annealing producing a smooth surface of uniform texture and having the natural color of the alloy on a plurality of similar stainless steel articles formed to a curved shape and having internal stresses due to the forming, comprising the steps of wetting the articles simultaneously with an aqueous solution of a surface tension-reducing agent and a salt of the group consisting of sodium nitrate, sodium carbonate and trisodium phosphate to form a coating on the articles.

521. *Method of Forming Insulating Coat on Steel and Composition Therefor*. By Paul E. Perry (Allegheny Ludlum Steel Corp.). U. S. 2,753,282. July 3, 1956.

To provide an insulating coating on the surface of electrical steel containing silicon which comprises, making a water solution of 5-75 parts by weight of primary magnesium phosphate, 10-135 parts by weight of mono basic ammonium phosphate, and about 1-6 parts by weight of chromic acid anhydride (chemicals represent 100 parts by weight total). Apply the solution as a film to the surface of the steel while they are in solution and baking the film and forming an adherent coating on the surface of the steel.

522. *Alkali Metal Phosphate Coating Solutions*. By H. Ley (Parker Rust Proof Co.). U. S. 2,758,949. July 14, 1956.

An improved alkali metal phosphate solution consists of an aqueous acidic solution of an alkali metal phosphate and a metallic ion sequestering agent from the group consisting of polyphosphates (1-20 g./l) and acetic amino acids and metallic salts thereof (0.77-7.7 g./l as ethylene diamine tetra-acetic acid). The composition of the concentrate is NaH_2PO_4 212 g./l; H_3PO_4 63 g./l; NaClO_3 118 g./l; and NaNO_3 15 g./l. One part of concentrate is diluted with 24 parts of water and the pH adjusted to 4.5.



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The purpose of this project is to establish a creative attitude of *dynamic alertness* on the part of all personnel in American industry.

Dynamic alertness is alertness on the move . . . is a positive, constructive way of thinking . . . a spirited new attack on your problems. It is swinging into action to get things done today . . . to insure a brighter, more prosperous future.

Three key words express the attitude of *dynamic alertness* . . .

- 1. Observation:** This means inspiring your people to look at your problems with curiosity and creative imagination. It is taking a walk through your plant and looking at things as though you are looking at them for the first time. It is cutting through the fog of complacency and seeing things with new eyes. It is looking for new ways to stop leaks and losses; searching for new ways to speed production and efficiency.
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of things to be done and sticking with them until they are finished. It is preparing today to solve the problems of tomorrow.

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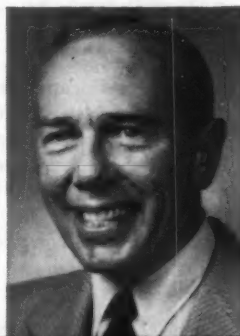
We at Udylite believe in Project Alert. All of us, to a man, are pledged to a policy of dynamic alertness in every facet of our jobs . . . in our contacts with fellow workers . . . in the handling of equipment . . . on the production line . . . in our contacts with suppliers and customers.

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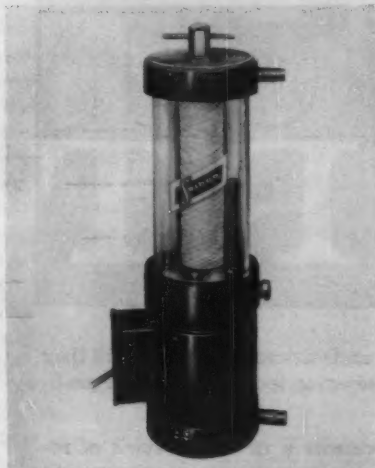
Recent Developments

NEW METHODS, MATERIALS AND EQUIPMENT
FOR THE METAL FINISHING INDUSTRIES



"Canned" Filter Pump

Sethco Mfg. Co., Dept. MF, 2284
Babylon Turnpike, Merrick, N. Y.



Completely "canned" in one compact unit housing a filter chamber, filter tube, pump and motor making a space-saving and portable solution filter is the new LEI series specially recommended for filtering expensive, sensitive, hazardous and critical solutions.

A principal feature is a pump which is inside a motor housing and magnetically driven by the motor. Stuffing boxes, rotary seals, shaft wear, coupling and alignment problems are eliminated. The results are long leak-proof, maintenance free operation. All pumping parts are fabricated of corrosion resistant stainless steel. Motor windings are isolated from pumping chamber by a stainless steel liner. Pump is driven by a $\frac{1}{8}$ h.p. totally enclosed 110V, 60 cycle, 1 phase motor supplied with a thermal starting and overload relay.

In line with the pump and motor is a full-view filter chamber of high temperature epoxy and Lucite or epoxy and Pyrex. This filter chamber contains one or more filter tubes of multi-layered processed cotton or special dynel yarn, porous stone or porous carbon providing effective depth filtration of solutions down to 1 micron in size. Gold, silver, palladium, preci-

ous metals are easily reclaimed simply by igniting the filter tube.

Conservatively rated at 100-150 gallons per hour for Model LEI-10 and 200-300 gallons per hour for Model LEI-20, the pump itself will deliver 1300 gal./hr. on open pumping. This high flow can be throttled by means of a pinch valve located after the filter chamber. Throttling has no effect on the motor; the motor simply does less work when pumping less liquid.

Models LEI-10 and LEI-20 each measure $6\frac{1}{2}$ " in diameter; and they are 23" and 33" in height (including portable handle) and weigh 38 lb. and 45 lb., respectively.

Polishing Wheel Lubricant

The Lea Mfg. Co., Dept. MF, 16
Cherry Ave., Waterbury 20, Conn.

AP Lubar is a new all purpose bar lubricant for use on polishing wheels and abrasive butts. It applies to the belt easily and uniformly, leaving an excellent wet surface. Loading or packing of abraded particles of metal on the cutting face of belts and polishing wheels is eliminated, and production life of belts and wheels is greatly increased, it is claimed.

Prolonged field tests have production-proved excellent results in polishing ferrous metals and non-ferrous metals, particularly aluminum and other soft metals. The product is packaged in cardboard cylinders $2\frac{1}{2}$ " x 7".

Dry Salt Substitute For Acids

Enthone, Inc., Dept. MF, 442 Elm
St., New Haven, Conn.

Enth-Acid 82, a new and improved dry, powdered replacement for liquid acids, is a blend of acid salts, activators and surfactants which is very effective for activating iron, steel, brass, copper or zinc-base die-castings prior to plating. It is also an effective pickling agent for removing rust, heat treating and welding scale from steel.

Acid solutions are easily prepared by dissolving the free-flowing salts in water at concentrations ranging from 4 oz. to 3 lbs./gal. depending on the

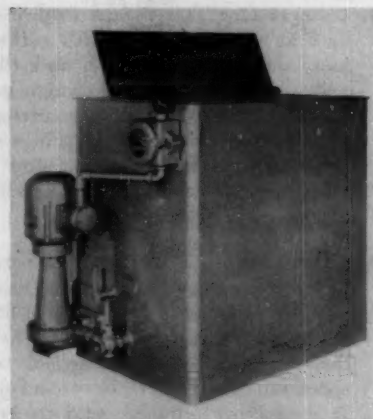
application. There are no objectionable fumes attendant with handling or dissolving the salts nor with the operation of the solution at room temperature. Solutions have a high residual acidity which assures the maintenance of the same degree of acidity over a long life span regardless of the amount of work processed.

In contrast with liquid acids, there are no hazardous, concentrated acids to be handled, no carboys to be broken or returned for credit. Additionally, the manufacturer claims that the activators in the product will produce brighter, cleaner surfaces prior to plating resulting in better adhesion and faster, more uniform bright plating.

Mask Washing Machine

Conforming Matrix Corp., Dept.
MF, 349 Toledo Factories Bldg., Toledo 2, Ohio.

A new mask washing machine designed particularly for the cleaning of large masks up to 42" in length, designated as the Model W-4200, features a non-ferrous splash-proof lid, visual fluid-level gauge, adjustable mask sus-



pension, pump intake strainer, and the fact that no pump seals are required.

Despite its greater cleaning capacity, it requires only 50 gallons of solvent for efficient operation. The non-clogging nozzles direct a powerful spray against both sides of the securely held masks simultaneously, to thoroughly clean the smallest openings, and most



Plating Progress



Published by SEL-REX CORPORATION

OCTOBER 1958

NUTLEY 10, NEW JERSEY

No. 5



Technicians inspect the miniature pins which had to be processed on a magnet to prevent loss during the plating operation.

Hughes Aircraft Company Plates Guided Missile Components with Sel-Rex Bright Gold

The manufacture of guided missiles requires the very best of materials... highest standards of quality. That's why Hughes Aircraft Company chooses Sel-Rex Bright Gold to plate miniature contacts and pins used in intricate missile systems.

Exclusive Sel-Rex Precious Metals Plating Processes are characterized by the retention of the desirable metallurgical properties of the particular precious metal — elimination of the objectionables. As examples, Sel-Rex Bright Gold is far more dense and twice as hard as conventional 24K Gold, and plates mirror-bright in any thickness directly from the bath; Rhodex eliminates the high tensile stress of ordinary Rhodium plate.

FREE LITERATURE CORNER

Just Off The Press...

- ☐ FC-1 • Printed Circuits Plating Developments. E. C. Rinker. Technical reprint, 4 pages.
 - ☐ PMF • Pre-Met Filter Leak-Proof, Low Cost Solution Filter Product Bulletin.
 - ☐ PLT-1 • Platinox—Reliable, low stream Platinum plating for high temperature and general industrial use.
 - ☐ EX-2 • Rhodium Electroplating Processes—24 pages, demonstrations and charts.
- Still Available...
- ☐ PMS • Precious Metals Refinishing Schedules.
 - ☐ PR-1 • Completely new "Guide" to Plating Rectifiers—20 pages, illustrated.
 - ☐ BR-a • Gold Plating, Industrial & Decorative, by E. C. Rinker—8 pages, illustrated.

NOTE: For your convenience, when requesting the literature you want, simply refer to it by the prefixed code.

Yet net costs are actually lower since fool-proof Sel-Rex Processes give you greater "milage" and make high reject rates old fashioned.

These reasons, and many others, explain why the instrumentation of the newest rockets, the earth satellites and many of the "hottest" airplanes have a Sel-Rex Precious Metal plate on their electronic equipment and circuitry.

Ask for CHP for complete literature and other case histories.

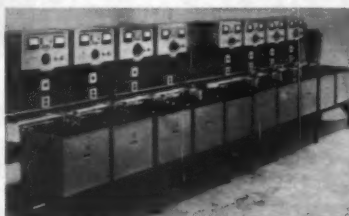
Plastic "Armor" Paints, Sprays, or Dips Thick, Air-Dry Coatings

A new plastisol can be painted, sprayed or dipped in coatings of 40 mils or more, for plating rack development, patching or general protective maintenance. The material adheres to any metal or other coatings, and air-dries to a tough, non-contaminating insulator-surface in less than 30 minutes.

A "Squeeze-on" applicator, filled with a generous supply of the plastic "armor", is supplied FREE with initial orders @ \$7.95 per gallon — while the supply lasts. Specially designed for patching or maintenance of those hard-to-reach places, the applicator is easily refilled and may be used over and over again. You may need Plastic "Armor" tomorrow, so order today.

Semiconductor Division Of Leading Electronic Manufacturer Installs Complete Plating "Plant"

A complete plating facility, including all tanks, rectifiers and equipment, was custom-designed for the semiconductor division of a leading home and industrial electronic equipment manufacturer.



The integrated assembly pictured above consists of ten separate tanks and eight rectifiers to handle electrocleaning, rinsing, hot acid dip, cyanide dip, copper strike, copper and tin plate. Two additional assemblies of seven tanks and five rectifiers each were designed to perform the cycles necessary to plate Sel-Rex Bright Gold, Silver and Rhodium on transistors and other miniature semiconductor products.

Each section is a completely packaged unit integrated with the customer's other manufacturing operations and includes fiberglass exhaust hoods and discharge plenums, electric outlets for rectifiers and immersion heaters, overflow standpipes for rinse tanks, and specially designed portable plating barrels.

This customer's purchasing department was pleased to discover that a custom-designed plating facility by Sel-Rex cost no more than "modified" stock equipment from other suppliers. Their production personnel will find that in the long run it will have cost far less.

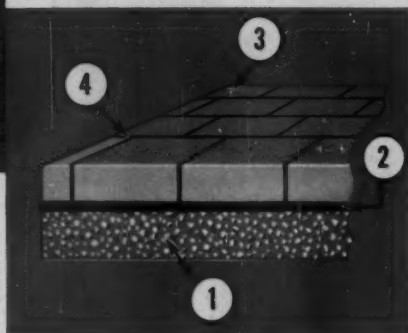
Are you planning plating facility installation, modernization or expansion? Sel-Rex maintains a complete engineering service to give you expert assistance in plant layout, design and installation — as well as quality equipment custom-designed to your specific requirements.

For more information and other case histories, ask for #PD & L.



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ACID PROOF FLOOR
will last for
FIFTY YEARS
or more!

... and will cost
practically nothing
for maintenance



- 1** It is built on a rigid, solid sub-base—4" to 6" thick.
- 2** The sub-base is protected by a thick corrosion-resistant "Resilon" membrane.
- 3** Over the membrane, a course of dense, tough, spall-resistant "USSCO" acid brick.
- 4** Bonded by wafer-thin, non-porous joints with "Durisite" acid-and-alkali resistant cement.

Yes, here's a corrosion-resistant floor that will outlast the building itself. Expensive? Savings in maintenance, alone, will make it over the years the lowest cost floor you can install.

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Detailed construction drawings showing approved methods of building floors, trenches, gutters, tank and motor supports, etc., with full technical data, photographs and case histories. Ask for Bulletin AB-17.



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U. S. STONEWARE

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barrel is then retracted to the loading station.

A signal operates the hopper or other loading device to meter out the next load. Then another signal starts the barrel rotating again, closing the barrel door. A detent clip holds the door closed during passage through the treatment cycle.

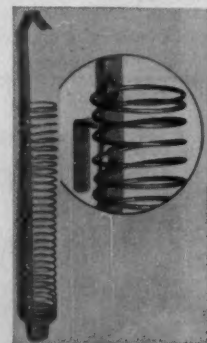
The barrel may be rotated continuously, intermittently, or not at all, in each tank, during each transfer, and at the unloading station. Controls may easily be adjusted for loading and unloading at the same end. These control features adapt the machine to many cycle variations.

Design is extremely simple. The only moving components are the elevator framework, which runs the length of the machine, and the work load. Chains and drive provide travel from station to station and return to starting point. Another drive lowers and raises the elevator framework.

The manufacturer says that a modification of the machine, now in development, would be adapted to more complex treatment cycles.

Weldless Anode Baskets

Belke Mfg. Co., Dept. MF, 946 N. Cicero, Chicago 51, Ill.



Resistance to the many new solutions that eat the welds of conventional welded anode baskets is provided by a new weldless anode basket. The $\frac{3}{4}$ " x 1" cold rolled spine is formed at the bottom to hold the coil

spring basket securely without welding. Die formed tongues from the spine also engage coils of the basket, thereby retaining the basket against the spine without welds.

delicate bridging and edges without damage.

Conversion Coating Machine

Hanson - Van Winkle - Munning Co., Dept. MF, Matawan, N. J.

A new, fully automated, straight-line conversion coating machine is recommended for blackening, phosphating, bright dipping, pre-cleaning and pickling.

"Convert-O-Matic," as the new machine is called, provides maximum cycling flexibility by settings of selected timers or each treatment tank. Once set up and turned on, the machine requires no labor at all. In addition to the substantial savings in labor, the

manufacturer claims that it offers maximum process control in conventional conversion coating operations of every type.

The prototype is fitted with a new barrel whose door opens and closes automatically to receive and discharge work. But the machine is equally adaptable to conveying baskets, tray loads or bulky parts suspended from the carrier.

An unloading station is provided beyond the final solution tank in the treatment cycle. Rotation of the barrel at this station actuates the lever mechanism that completely opens the door and discharges the work. Rotation is continued until the opening is properly positioned to receive the next load. The

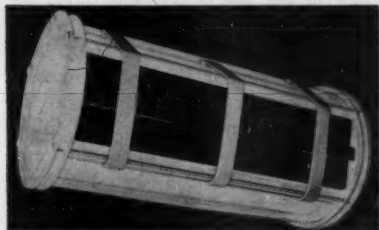
It is available as illustrated, also with the special hook shown in the inset, which is used to hold the basket high in order that the operator may see when more anodes are needed, and also furnished curved to specifications.

Standard length, hook to basket is 6 inches. Standard basket lengths are 18, 21, 24, 27, and 33 inches.

Bolted Plating Cylinder

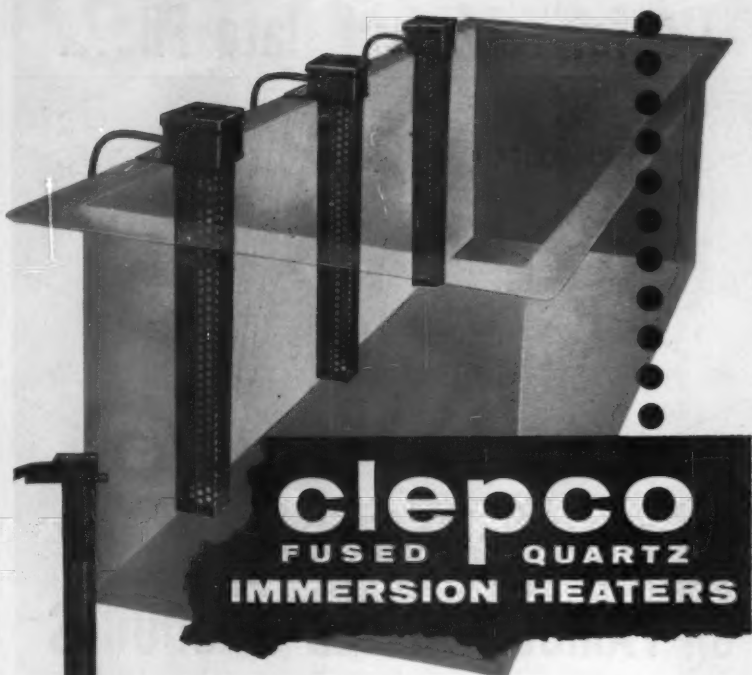
G. S. Equipment Co., Dept. MF,
15585 Brookpark Road, Cleveland,
Ohio.

Ending down-time and high-costs of outside repairs, rebuilding, etc., is the new, extra rugged, "Trussed-Rib" bolted plating cylinder. This is claimed to be the first cylinder offering the trussed-rib, all-bolted construction for greater strength (275-lb. loads), a new high in performance (temperatures to 220°F, busied for 1420 amps, through-cycle), and cost-saving, simplified



maintenance (replace any component part in 20 min., regardless how long in service). Recommended for acids, alkalies, electrolytic alkaline descaling, all plating solutions, and other surface treatments, it is said to outlast conventional cylinders as much as 3 to 1 under equal conditions; and operate efficiently in solutions conventional cylinders can't tolerate.

Cylinder panels are tongue and grooved into heads and heavy 2" square ribs; and "trussed" full-length from head-to-head by $\frac{1}{8}$ " dia. stainless steel rods coated with bake-on plastisol. Rods are fastened at both ends using stainless steel washers and nuts, recessed into heads, and covered by Plexiglas caps. Each cap is sealed with air-dry plastisol to protect against corrosion, etc. All parts are easily, quickly replaceable by platers on their own premises, using only a $\frac{1}{2}$ " wrench. No special skill or equipment needed. All parts are immediately available from stock. Corresponding parts in Plexiglas, Polydur, and Tempron are interchangeable. Cylinders can be assembled in all three materials, or in any combination.



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FUSED QUARTZ
IMMERSION HEATERS

**FAMOUS THROUGHOUT
THE PLATING INDUSTRY**
For Quality, Efficiency, Low Cost Operations

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CLEPCO ELECTRIC IMMERSION HEATERS

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will meet all your specific needs.

Low Heat Density — Long Life — Vapor-proof Junction Box.

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THE CLEVELAND PROCESS COMPANY

1965 EAST 57TH STREET • CLEVELAND 3, OHIO

Components are standardized to avoid danger of obsolescence regardless of new material developments. Usable parts need never be wasted. Polydur doors are standard, Plexiglas and Tempron optional. Cylinders are available in models to fit all belt or gear drives; all makes, types, size.

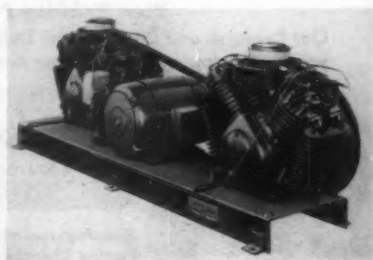
Air Compressors

The DeVilbiss Co., Dept. MF, Toledo
1, Ohio.

New 20 and 25 horsepower, 125 and 175 pound air compressors have double compressor units, and displace from 96.4 to 129 feet of air per minute. They are equipped with pressure switch and magnetically controlled un-

loaders. A magnetic starter with selector switch for automatic start-stop operation or constant speed unloading is available as are vertical air receivers for remote installation.

The vee-type multiple-cylinder compressors have a bore in the first stage of $4\frac{1}{2}$ inches and $2\frac{1}{2}$ inches in the



Useful Technical Data File...



on FAMOUS ALLIED PRODUCTS

For Finishing, Cleaning and Protection of Metals

Here's a wealth of technical information gathered as a result of extensive product research, development and use throughout the world. This comprehensive file explains and describes all products, gives applicable metals, appearance of film, purpose of products, typical applications, U. S. Government specifications, method of application and test results.

IRIDITE The finishing industry's most complete line of chromate conversion coatings. Give peak corrosion resistance, a lasting paint base and widest choice of appearance in decorative finishing on

ZINC AND CADMIUM ALUMINUM CUPROUS ALLOYS MAGNESIUM SILVER

ARP BRIGHTENERS Liquid and powder materials for barrel, still or automatic ZINC and CADMIUM plating. High chemical stability provides maximum quality at minimum cost. Liquids available in AUTO-FLO-PAK for economical automatic dispensing.

ARP PROCESS CHEMICALS

WETTING AGENTS DETERGENTS DYES FOR IRIDITE FILMS

ARP CLEANERS and DEOXIDIZERS Specially formulated to provide maximum performance with IRIDITE coatings on aluminum and zinc die castings.

IRILAC New method of protection incorporating corrosion inhibitors in a water-soluble polymer base which dries to an extremely thin, tough, durable coating—clear in color. Does not chemically affect base metal or any post treatments. Used as a protective treatment alone or to enhance value of post treatments.

Write now for your copy of Allied's Technical Data File, or call your Allied Field Engineer for full information on Allied products. He's listed in your phone book under "Plating Supplies".

Your Finishing Problems Invited

Our Research and Development Department will be happy to work with you to develop a finish for your needs.

Allied Research Products, Inc.

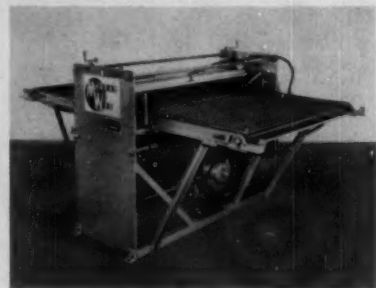
4004-06 E. MONUMENT STREET
BALTIMORE 5, MARYLAND

Manufacturers of IRIDITE®, IRILAC™, ARP® Brighteners and Plating Chemicals—West Coast Licensees: L. H. Butcher Co.

second stage. The stroke is 4 inches. Length is 88", height 28 $\frac{3}{8}$ " and width 28". Domestic shipping weight is approximately 1700 pounds and 2000 pounds for export.

Roller Coater

Murray-Way Corp., Dept. MF,
Birmingham, Mich.



A new budget priced roller coater is especially designed for in-line use in automated production. This space saving, Model "C," is of sturdy steel plate construction and provides uniform application of draw compounds, waxes, sealers, rust inhibitors, paints, and varnishes. One or both sides of continuous roll or sheet material can be coated with an accurate film thickness. It is available in widths and specifications desired by the purchaser.

A rod-type, sprocket-driven conveyor is optional, and will be provided in length desired. Flexing occurs only in the drive chains of this conveyor, insuring that there will be no flake-off to contaminate coatings.

The roller coater operates at variable speeds and can be self-powered or synchronized with automated lines. Top rolls may be fixed or hinged for ease in cleaning as purchaser desires.

Rhodium Concentrate

Technic, Inc., Dept. MF, 39 Snow St., Providence, R. I.

Rhodium Sulphate T.P., an improved new rhodium concentrate recently introduced, is described as superior for meeting present day electroplating specifications.

Lower stress, higher purity and finer grain are cited as advantages which make the new concentrate especially suitable for chemical, electrical, electronic, nucleonic and other design applications.

To enable prospective users to appraise the potential of the new product, the manufacturer presently is making available a test quantity of 10 grams, with complete instructions, at a special

sampling price. Testing is easy, because of the high compatibility of the new concentrate with existing rhodium baths.

Olive Drab Conversion Coating

Conversion Chem. Corp., Dept. MF, Rockville, Conn.

Because it's a powder, furnished in a non-returnable package, shipped at lower freight rates, a new olive drab coating for cadmium saves cost.

Known as Kenvert No. 11-PC, this powder when used with a nitric acid adjustment will produce a hard, olive drab deposit on cadmium plated surfaces. This assures maximum corrosion protection to the cadmium. It easily meets the requirements of Spec. QQ-P-416, Type 2. It may be dyed black with Kenvert No. 11-B or a variety of Kendye colors for coding and identification purposes.

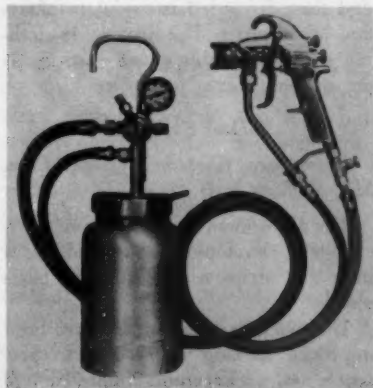
The bath is stable, does not oxidize or deteriorate when not in use. Constant color may be maintained. The finish is an excellent base for paint.

Portable Spray Unit

Binks Mfg. Co., Dept. MF, 3122 Carroll Ave., Chicago, Ill.

A new, highly portable spray paint outfit, called the "Steady-Grip," features a two-quart pressure cup, separated from the spray gun, allowing the painter complete freedom of movement while painting. Now difficult surfaces can be sprayed easier and quicker since there is no heavy cup attached to the gun to hinder strokes while painting. At the same time, the danger of paint drip from vent holes is eliminated by keeping the two pieces of equipment separate.

Production quality painting is possible due to the air and material regulators included with the outfit. Accurate pressure settings give perfect coverage every time without runs, sags and dust.



PRECISE TEMPERATURE REGULATION just MADE for metal finishing

Get better cleaning, plating and coating . . . save materials, steam, labor . . . cut rejects by insuring precise temperature regulation with this Sylphon® No. PA-2 Temperature Regulator. Sturdily constructed for long life in the plating room, this self-operating unit is simple, dependable and easily adjusts for desired temperature. Dial thermometer is large and extra legible. Stainless steel frame and valve trim, and plastisol coated bulb resist corrosion from virtually all metal finishing chemicals. Temperature ranges of 60° to your specifications.

WRITE FOR BULLETIN TT-548



Robertshaw-Fulton

CONTROLS COMPANY

FULTON SYLPHON DIVISION • Knoxville 1, Tenn.

1.7/3.0 microns: **THERMARED** **IMMERSION** **HEATERS**

Featuring
VAPO-VENT
VAPOR and LIQUID
TIGHT VENTING ASSEMBLY
ON ALL METAL HEATERS
and
NEO-TITE
VAPOR and LIQUID
TIGHT ASSEMBLY
ON ALL QUARTZ HEATERS

THERMARED, an improved line of immersion heaters, presented by N.J. THERMEX, introduces a new innovation of vapor venting to eliminate internal explosion in Quartz heaters. The VAPO-VENT assembly provides a venting system for expanding gases, a completely liquid sealed head assembly and an extremely versatile unit which permits field repair with standard replacement. These exclusive THERMARED features are further aided by the NEO-TITE vapor and liquid tight assembly which protects the heating elements in both Quartz and Steel units. Here at last, is a thoroughly versatile unit permitting even accidental total immersion in highly corrosive chemicals with no harm to the equipment.

*ON QUARTZ HEATERS

**N. J. THERMEX
COMPANY, INC.**

535 - 533 BERGEN ST., HARRISON, N. J.

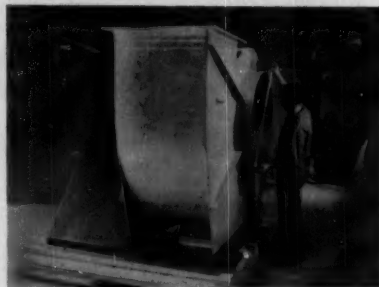


and minimize the need for attention.

Each pump is dynamically balanced to reduce vibration, and incorporates a streamlined belt-guard to provide maximum safety. A completely automatic lubrication system, combined with the latest shaft-seal arrangement, insures low maintenance and trouble-free operation.

Giant Plastic Fan

The Heil Process Equip. Corp., Dept. MF, 12901 Elmwood Ave., Cleveland 11, Ohio.



The photo above shows a new all plastic fan, one of the largest fans of glass reinforced plastic produced in the U.S.A. and is known as #36-Rigidon. It was supplied for a metal finishing establishment where ventilation of chemical corrosive fumes was involved. The special conditions required engineering this piece of equipment to handle and resist mixed acid fumes. All parts exposed to the chemicals being exhausted are of solid plastic and no painting is required on any surface, either on the inside or out.

The fan will handle 27,500 cfm. Other standard plastic fans are available in capacity to 35,000 cfm at this time.

Disposable Clothing

Textile Products, Dept. MF, 181-189 Chestnut St., Newark 1, N. J.

Industrial clothing that can be worn and then discarded is useful in plants and laboratories. The disposable clothing is now available as lab coats, jackets, aprons, shirts, pants, etc.

Nickel Stripper

Hampshire Chemical Corp., Dept. MF, Nashua, N. H.

The above manufacturer reports several new developments in Ni-Plex, a bath that strips nickel from all basis metals.

The two new concentrates have been improved making it possible to present a new package and simplified 1 to

ty finishes. The two-quart cup also allows the painter to cover greater areas between refills.

This new unit is ideal for all types of lacquers, enamels, multi-color, and standard house paints.

Rotary Vacuum Pumps

F. J. Stokes Corp., Dept. MF, 5500 Tabor Road, Philadelphia 20, Pa.

Each of the new "H" series of "Microvac" rotary vacuum pumps is distinguished by larger pumping capacity, increased volumetric efficiency, low power requirements, improved gas ballast to minimize oil contamination, and more compact design. The slim vertical lines of the pumps which make for minimum floor space requirements

have been retained and the overall height has been reduced by the introduction of an offset-angled piston-and-slide mechanism. New poppet-type exhaust valves make operation quieter



1 mixing ratio. The stripper will now be packaged in two standard sizes of multipac containers for ordering, inventory, and handling economies for customers.

500-Watt Ultrasonic Cleaner

Narda Ultrasonics Corp., Dept. MF, 625 Main St., Westbury, N. Y.

A new Series 5000 Narda SonBlaster ultrasonic cleaner for really large-volume cleaning operations is priced at only \$1,325. $\frac{1}{2}$ to $\frac{1}{3}$ less than com-



petitive equipment, and features a generator with full 500 watts output, plus a fully transducerized 10-gallon tank. The generator is equipped with tank selector and load selector switches so that it can operate either one or two ultrasonic tanks alternately, or submersible transducers in tanks up to 30-gallons capacity. Tank dimensions are 20" long by 11 $\frac{1}{2}$ " wide by 10" deep.

Alternatively, the generator will operate from six to ten high-energy submersible transducers, at any one time, for use in any arrangement in any shape tank up to 70-gallon capacity.

Protective Packaging Film for Metal Products

Daubert Chem. Co., Dept. MF, 333 N. Michigan, Chicago 1, Ill.

A newly patented film, Nox-Rust Clear-Pak, is based upon Du Pont's Mylar to which has been applied a heat sealing composition containing volatile corrosion inhibitors. Unlike conventional opaque VCI packaging materials, the film not only protects precision metal parts from rust and dirt, but permits easy inspection and identification of the item without unwrapping.

The high-strength polyester film, resistant to moisture, oils, and greases is available in rolls or in the form of pouches to order. It may be used on automatic packaging machines, or heat-sealed by hand. No rust preventive oils or greases are required on the packaged metal products.

THE NEW VERSATILE NON-DESTRUCTIVE COATING-THICKNESS TESTER DERMITRON



Unit Process Assemblies, Inc., pioneers in non-destructive testing and specialists in electronics for metal finishing, offer their latest DERMITRON D-2 with these features:

- Measures plated coatings on steel, brass, copper, zinc die-cast, aluminum, nickel-silver, bronze and other metals; also nickel on steel.
- Measures anodize and hard-coat on aluminum and magnesium; also paint, porcelain, organic coatings on non-ferrous metals.
- Measures metal coatings on plastics, ceramics and other non-metallic materials.
- Sorts or matches metals and alloys.
- Available with FOUR measuring probes for extra-wide thickness ranges from thin to thick deposits.
- Special probes can be provided for measuring on internal diameters, small diameters and otherwise inaccessible areas.
- Only $\frac{1}{4}$ " circle area required for measurement.
- You get fast (within seconds), accurate, direct readings, plus versatility and portability.

Write for latest brochure and questionnaire to help solve your thickness testing problems.

UPA

UNIT PROCESS ASSEMBLIES, INC.

61 East Fourth Street • New York 3, N. Y.

Spray Orifice Tips

Spraying Systems Co., Dept. MF, 3201 Randolph St., Bellwood, Ill.

A new set of flat atomizing orifice tips with tungsten carbide inserts offer

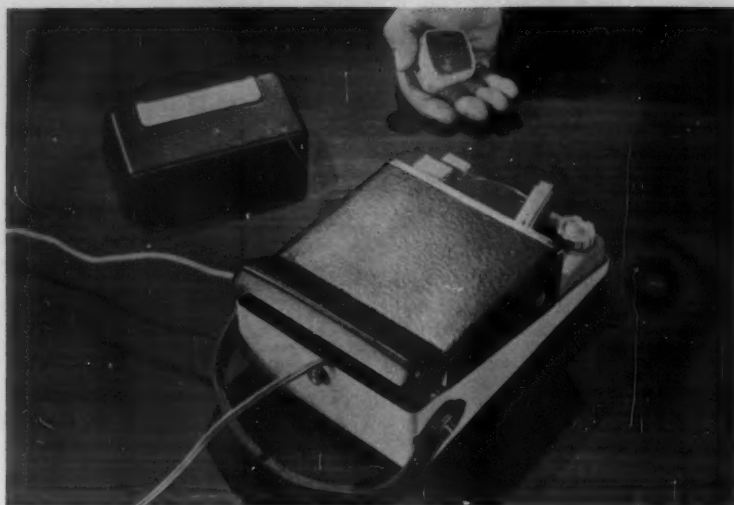


a high resistance to solutions containing abrasive particles. Tips of this type were developed for use in airless paint spraying, but are also finding use in other high pressure applications where abrasion causes rapid orifice wear. Precision tolerances are maintained in the manufacture of these tips to assure uniform spray particle size and distribution at the smaller spray volume capacities usually required. Tips are supplied in —0033, —0050 and —0067 sizes, giving spray angles at 40°, 50° and 65° respectively.

Aluminum Paste

Reynolds Metals Co., Dept. MF, Richmond 18, Va.

A new aluminum paste with im-



ARMORSOL® coating on **SOUNDScriber**

New vinyl metal coating in same price range as baked enamel and five times as abrasion resistant.

Basically a one-coat finish applied to metal, competitive with baked enamel, Armorsol can be made smooth or textured for approximately the same cost as baked enamel. Yet it is five times as abrasion resistant. Armorsol is a new and entirely different kind of vinyl metal coating requiring no primer, and has physical and chemical properties unlike any other finish.

Write today for free booklet and sample panel.



JOHN L. ARMITAGE & Co.
Synthetic Enamels, Paints, Varnishes, Lacquers
 245 THOMAS STREET - NEWARK 5, NEW JERSEY

proved performance for alkyd and other type synthetic resins, designated "Perma-Leaf" No. 7-311, maintains leafing in many paint vehicles which normally cause deleafing within a few days, according to the manufacturer.

The new paste has been used successfully with some alkyds, alkyd melamine, urea formaldehydes and vinyls. Such use will permit marketing of aluminum paints with these vehicles ready-mixed. Formerly these types of paints could be sold only in two-compartment containers for mixing on the job.

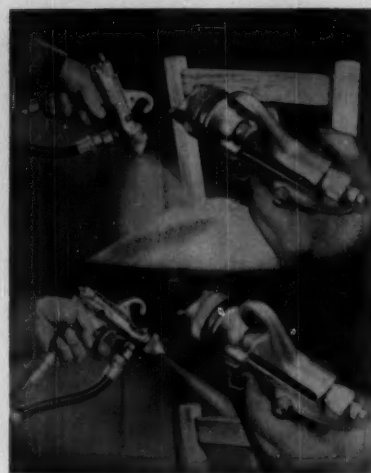
The following characteristics are listed for the paste: NVM 70% minimum, screen retention 325 mesh 1.0% maximum, weight per gallon 12.12, and specific gravity 1.45.

Spray Gun

*Eclipse Air Brush Co., Dept. MF,
390 Park Ave., Newark, N. J.*

High-Low Spray-Rod is a new precision top production hand spray gun which features redesigned and refined internal and external nozzles, providing extremely fine atomization and near perfect uniformity of spray.

Designed for greater operator comfort, versatility and convenience, the new hand gun allows one-hand instantaneous control of spray pattern with either external or internal atomization; internal to external atomization (vice versa) is accomplished merely by changing nozzles, without use of tools. The original low center of gravity



contour fit has been refined for even greater comfort.

Push-button fan control on the new gun not only saves paint, but gives the operator the kind of control that will save spray booth maintenance and clean-up. With a flick of the thumb or forefinger the fan control is instantly changed to either of two completely adjustable fan widths: cone to wide fan, wide fan to cone, with either internal or external atomization.

Other important construction points of the tough, light weight gun are: Removable plunger, which is unscrewed and replaced by hand in seconds; protected trigger, contained inside the handpiece away from rough usage or dried paint; stainless steel on all critical parts and those in contact with fluid or air; and a clean, streamlined design with no exposed threads which permits easy maintenance.

Treated Buff

*American Buff Co., Dept. MF, 2414
S. La Salle St., Chicago 16, Ill.*

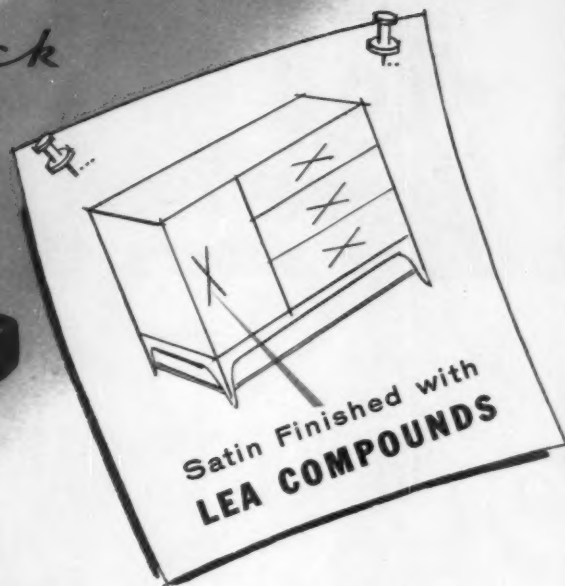
A new treatment is claimed to make any cotton or sisal buff tougher, longer-lasting and more efficient. Thoroughly impregnating the buff fabric, this Black Treatment penetrates every fiber of cotton or sisal, stepping up strength and endurance, permitting longer runs at lower cost.

Its toughening agent also has two other beneficial aspects. By bonding fibers more firmly together, it eliminates fraying, improves cut and color, prevents streaking. Its slightly "tacky" texture holds buffing compound better, thus requiring less compound to produce a greater volume of output, again resulting in lower costs.

Satin ELEGANCE

in Modern
Furniture Hardware

by *Bassick-Sack*



BASSICK-SACK, a division of Stewart-Warner Corporation, is one of the country's largest manufacturers of fine furniture hardware... and much of this hardware is Lea Satin Finished.

Bassick-Sack says, "In the finishing of all of these parts we use various Lea Compounds, particularly in our buffing and polishing processes, and we are pleased to state that these compounds afford us the fine lustre and quality finishes that are demanded by our customers and the consuming public."

So, for your consumer products, why not try a LEA Satin Finish. Here is a modern finish, a quality finish, a durable finish, a low cost finish... a finish that both sales and manufacturing will go for. Write us today for further information on LEA SATIN FINISH.



Burring, Buffing, Polishing, Lapping, Plating and Spray Finishing... Manufacturers and Specialists in the Development of Production Methods, Equipment and Compositions. Manufacturers of Lea Compound and Leacok... Industry's quality buffing and polishing compounds for over 30 years.

THE LEA MANUFACTURING CO.
16 CHERRY AVE., WATERBURY 20, CONN.

Lea-Michigan, Inc., 14066 Stansbury Ave., Detroit 27, Mich.
Lea Mfg. Company of Canada, Ltd., 1236 Birchmount Road, Scarborough, Ontario, Canada
Lea Mfg. Company of England, Ltd., Buxton, England
Lea-Ronal, Inc., Main Office and Laboratory: 139-20 109th Ave., Jamaica 35, N. Y.
Manufacturing Plant: 237 East Aurora St., Waterbury 20, Conn.

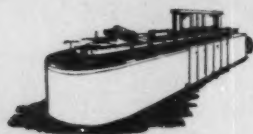
Are you interested in plating specialties? See the other side of this insert

Something New and Better

for you to investigate



NICKEL-GLEAM N222*



*Users are getting
EXCEPTIONAL LEVELLING
without sacrificing
Throwing Power • Ductility •
Chromium Receptivity*

Because of its versatility, N222 can be used effectively with either mechanical or air agitation... in fact, without agitation should none be available. And all this plus high tolerance to organic and metallic contamination! You can switch over to NICKEL-GLEAM N222 without changing conditions under which you prefer to operate. You will get better results. A trial run will prove it.

NICKEL-GLEAM N222 is a product of Lea-Ronal Research Laboratory widely experienced in plating procedures and responsible for some of the most productive formulations being used today.



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*Patented

Are you interested in Buffing, Polishing and Burring Specialties? SEE THE OTHER SIDE OF THIS INSERT.

Degreasing Solvent

Tect, Inc., Dept. MF, Northvale, N. J.

Vythene-E spray cleaner is a specially purified grade of Vythene which has an exceedingly low percentage of non-volatile material and a boiling range narrower than that of commercial 1,1,1-trichloroethane.

As with its parent product, the new material is approximately 20 times less toxic than carbon tetrachloride and has no flash point. In addition, the product is highly stabilized to all metals including aluminum and can be successfully reclaimed by distillation.

The solvent is now available in specially cleaned and sealed quart glass bottles and in 55 gallon lined drums.

Processing Machines

Metal Processing Dept., Pennsalt Chemicals Corp., Dept. MF, 3 Penn Center, Philadelphia 2, Pa.

A new series of automatic metal processing lines, designed for compact size and costing from $\frac{1}{3}$ to $\frac{1}{2}$ as much as previously available machines of this type, wash, rinse, coat and dry steel plates or blanks at processing speeds from 30 to 80 feet per minute. They can be used for applying drawing lubricant, for phosphating, or for a variety of other metal surface treatments.

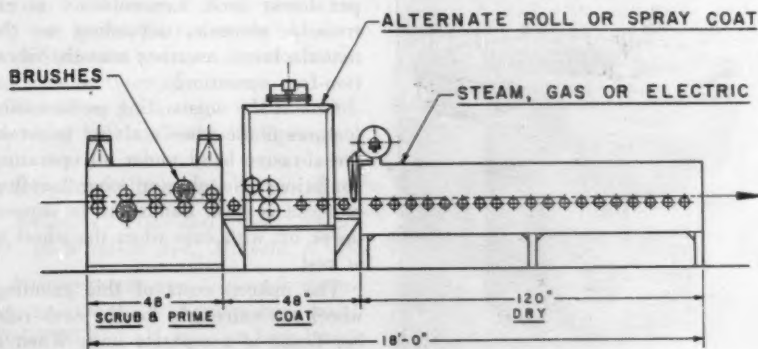
Conveyor widths are from 20 to 72 inches. Roll spacing permits handling of sheets with minimum lengths of 30 inches; special spacing allows use of sheets down to 22 inches wide.

The complete processing line consists of a scrubbing and priming section, a coating section, and a drying section. Sheets move automatically through the system on a line roll conveyor. Coating operation is by roll or spray. When spray is used, the spray guns are adjustable and use air atomi-

zation. The drying section can be supplied to operate by steam, gas or electricity.

Installation, start-up and continuous

maintenance are supplied by the manufacturer's field specialists, who also handle cleaning and coating compounds and are able to offer complete service on a regularly scheduled basis to users of the equipment.



**NO HIGHER QUALITY
CAN BE DELIVERED
SO CONSISTENTLY...**



**99.75%
PURE**

And you get prompt delivery from ample factory and nearby distributor stocks.

Next time you're in the market why not send us a modest order just to find out how good BFC Chromic Acid really is.

BETTER FINISHES & COATINGS, INC.

268 Doremus Avenue, Newark 5, N. J. • 2014 East 15th St., Los Angeles 21, Calif.



Rotary Conveyor for Polishing Head Units

Divine Bros. Co., Dept. MF, Seward Ave., Utica, N. Y.

Model "RJ" rotary conveyor of the indexing type for use with polishing, buffing and brushing head units on automatic installations, consists of a heavy welded steel base, cylindrical in the main section, into which is mounted the complete dial and work spindle

EGYPTIAN "COMPOSITE BAKE" METAL PRIMERS can double your oven capacity too!



"Composite Bake" . . . the simultaneous baking of the Egyptian System of Metal Primers and Top Coat in one pass thru the oven.

Recently one of America's largest Manufacturers of Air Conditioning Equipment found himself wrestling with the finishing room bug-a-boo that eventually plagues every volume product manufacturer . . . overtaxed oven facilities — resulting in non-productive finishing room man-hours.

At the suggestion of his Egyptian Finishes Specialist he momentarily laid

!Name upon request.

- EXCELLENT ADHESION to practically any metal surface.
- WILL TAKE MOST ANY TOP COAT — Lacquer or Synthetic Enamel.
- SMOOTH FILM and excellent "Enamel-Holdout"
- GOOD RUST RESISTANCE — Corrosion Inhibiting Pigments.
- SUITABLE FOR EXTERIOR EXPOSURES.

Listening to the complete Egyptian "Composite Bake" Story could point out the way to cut costs in your finishing room too. Invite an Egyptian Industrial Finishes Specialist to call on you TODAY, or write for detailed information. No obligation of course.



Industrial Finishes

The EGYPTIAN LACQUER MANUFACTURING COMPANY

BOX 444, NEWARK 1, NEW JERSEY

EXECUTIVE OFFICES, ROCKEFELLER CENTER, N. Y. • Plants: South Kearny, N. J.—Lafayette, Ind.

driving mechanism. A louver door at the lower front of the base provides easy access to the dial drive motor, fixture drive motor and mechanism within.

The mechanism consists of a gear reduction and variable speed drive for the dial plate, which includes an intermittent motion for indexing the dial. The gear reduction unit, variable speed drive, and chain and sprocket assembly for rotating the six fixture spindles are also included in the base.

A separate podium-mounted push-button panel provides mounting for stations which operate all motor controls. This permits relocation of the pushbutton panel for maximum convenience. Each motor is individually controlled. Motor starters and fused

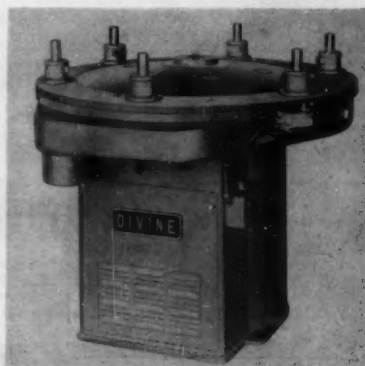
aside the obvious solution . . . additional baking units — and made a trial run, switching to Egyptian "Composite Bake" Metal Primers.

Here's how the tally sheet read: (1) — Oven capacity doubled. (2) — Non-productive man-hours practically eliminated. (3) — No additional baking equipment required.

In addition to these production advantages, Egyptian "Composite Bake" Metal Primers brought these highly desirable finishing characteristics:

disconnect switch are assembled in a separate panel for mounting to wall or column near the machine.

Speed adjustments for indexing drive and work spindle rotation drive are



accessible by opening the front louver door.

The work holding dial is provided with six ball bearing mounted fixture spindles 1½" diameter x 3". The dial index rate is adjustable from 120 to 1800 indexes per hour, with the fixture spindle speed adjustable from 12 to 100 rpm. Other speeds are also available.

An automatic release is furnished so that the two fixture spindles at the front of the machine are not rotating, for easy loading or unloading. Individual drives of fixture (work holding), and of dial indexes make for easy adjustment to obtain maximum finish and production. The fixture spindles are equally spaced on a 45" diameter circle. The dial diameter is 51", and the fixture spindle tops are 42" from the floor.

A similar model is also available for applications where a continuous dial motion will be more suitable than the indexing type.

Flexible Grinding Wheel

Nu-Matic Grinders Inc., Dept. MF,
8224 Carnegie Ave., Cleveland 3, Ohio.



A new addition to the line of Flex-core expanding-type grinding wheels, Model 004 is 4 inches in diameter and offers complete flexibility of width selection.

The new core design is made of extruded aluminum. This design facilitates the custom sizing of the individual wheels to meet specific use requirements. The aluminum core also provides considerable weight saving; the complete wheel weighs only 10 ounces per linear inch. Concentricity is extremely accurate, according to the manufacturer, assuring smooth, vibration-free operation.

One of the outstanding performance features is the wheel's ability to retain the abrasive band under all operating conditions. No glue or other bonding material is used. Bands can be slipped on or off with ease when the wheel is at rest.

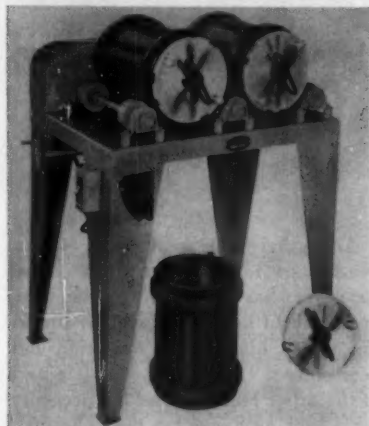
The upkeep costs of this grinding wheel are extremely low as each rubber flexer is a separate unit. When a

flexer becomes damaged, the operator simply slides it out of its keyed retaining slot in the core and inserts a new one. At no time is it necessary to scrap the complete wheel.

The line now includes models with diameters of 3 inches, 4 inches and 5 inches in a variety of widths and types of flexers.

Barrel Finishing Machine

Globe Barrel Finishing Equip. Div.,
Casalbi Co., Dept. M.F., Jackson, Mich.



An entirely new barrel finishing machine incorporates a one piece pressure molded rubber barrel, driven on rollers. Because the barrel is molded in one piece, there are no joints or crevices in which particles of abrasive might wedge, contaminating subsequent operations.

The barrel cover is made of aluminum and is quickly detachable with a few turns of the handle. When the handle is locked in position, the barrel is perfectly water-tight. Inside the barrel are three integrally molded ribs to assist the agitating of parts.

The barrels can be used for all barrel finishing operations: i.e., deburring, descaling, polishing, radiusing, grinding, and burnishing. An excellent advantage is that, with one extra barrel, the machine need never run with only one barrel. Extra barrels can also be utilized as a storage place for various sizes or types of media.

The drive is through V-belts and the roller bearings are self-aligning.

5-Gallon Ultrasonic Cleaner

Acoustica Associates, Inc., Dept.
MF, 26 Windsor Ave., Mineola, N. Y.

A super-power new ultrasonic cleaning unit with a 5-gallon-size tank, Model DR-250-AH, has just been intro-



**WILL HELP
YOU SOLVE
YOUR FLAT
FINISHING
PROBLEMS**

AVAILABLE IN
6" - 3" - 8" SIZES WITH
SINGLE OR MULTIPLE
HEADS
OTHER MODELS TO 12"
ALSO AVAILABLE

Fast, uniform finishing of flat parts!

Grind and polish metal or plastic parts in one semi-automatic operation! Where high production and consistent finishes are required, look for these Hammond features:

AUTOMATIC AIR TENSIONING: maintains correct tension on abrasive belts and conveyor belts.

VARIABLE SPEED CONVEYOR: rate of feed is adjustable from 0 to 60 FPM.

WORK HOLDERS: hold-down rolls, electro-magnetic platen and various types of conveyor belts.

AMMETER CONTROL: an ammeter for each head allows operator to determine and maintain the polishing pressure necessary for a uniform finish and longer belt life.

V-BELT DRIVE: allows abrasive belt speed to be changed to suit the work.

Send samples and production requirements for
an engineering report on your finishing job.

Hammond Machinery Builders

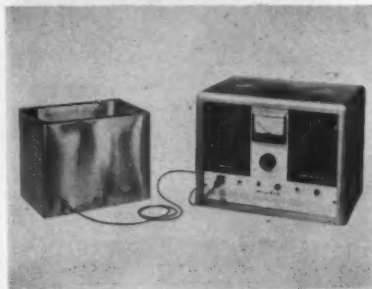
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SEE US NAT'L METAL EXPOSITION — BOOTH 1250 — OCT. 27-31 — CLEVELAND

**TYPICAL PARTS
FINISHED WITH
THE FF-6**



duced at the low price of only \$745. An important feature is the pulsing generator which delivers an output of 1 kw peak power. This intense power makes possible maximum cavitation, the effective cleaning process in an ultrasonic device, with minimum power consumption. This powerful cavitation,



distributed in a uniform ultrasonic field within the liquid medium, makes possible ultra-rapid, extra-thorough cleaning, descaling, degreasing, or decontamination of soiled parts and intricate assemblies of all kinds.

The transducerized 5-gallon stainless steel tank has working dimensions of 14" length x 10" width x 9½" deep. Designed for continuous duty operation and constructed of the finest components available, the new cleaner is made for rugged, reliable, and fool-proof performance, easier maintenance, and more efficient operation at the lowest cost available on the market today. No special wiring or installation is required; just plug in to conventional 115 V AC outlet to operate.



Note Carefully These IMPORTANT POINTS

Barrels can be filled with parts or abrasive—while running.

Work can be watched—samples removed for inspection—while running.

Angle can be changed for best abrasive or polishing action—while running.

Barrels can be emptied by tilting to pouring position—while running.

Barrels are made in various sizes, shapes, and materials. They are easily replaced.

If You're a Tumbler, Send for This NEW CATALOG

THE HENDERSON BROS. COMPANY

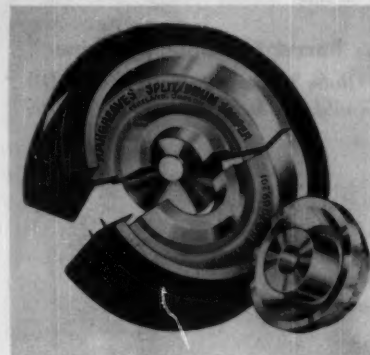
"The Tumbling Barrel People"

136 SOUTH LEONARD STREET
WATERBURY, CONNECTICUT

sition indexing switch on the control panel. A lighted schematic diagram on the panel indicates valve position, providing a simple visual check of the unit's operation.

Split Drum Sander

Hargreaves Industrial, Dept. MF,
120 N. W. Ninth Ave., Portland 9, Ore.



An entirely new split drum sander, which uses low cost strips of coated abrasives, has no hinge, so the common fault of hinges cracking or breaking under high speed operation has been solved. The locking cone is a part of the arbor bushing, and the necessity for a backing flange has been eliminated due to the simplified design of the tool. Actually, a backing flange is included with the new sander but, if it were accidentally left off the assembly, no damage would result as long as the wheel is tight against a shoulder on the arbor spindle. The pins that secure the abrasive strips have been re-arranged to simplify loading the abrasive strips, and to provide a tighter wrap around the wheel.

The sander is available now in 6" diameter sizes (widths of 1", 1½", 2", 3", and 4"). Other diameters, 3" through 12" will be available within the near future.

Acid Mist and Vapor Collector

American Air Filter Co., Inc., Dept. MF, 215 Central Ave., Louisville 8, Ky.

A new acid mist and vapor collector is claimed to achieve a higher collection efficiency than conventional wet dust and fume collectors, yet it is lighter, less bulky and lower in cost. It is designed especially to eliminate acid or alkali mist generated in plating and other industrial processes.

The Type M Cycoil may be operated either as an exhaust or blow-through cleaner, with the contaminated air or exhaust gas flowing upward through a perforated plate into the eliminator section. The eliminator section consists

Production Vacuum Coater

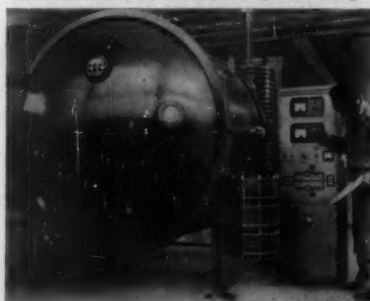
Rochester Div., Consolidated Electrodynamics Corp., Dept. MF, 1775 Mt. Read Blvd., Rochester 3, N. Y.

A 72-inch vacuum coater with six stations will hold work pieces up to 22 by 50 inches. Labeled LC1-72, the new coater assures the operator of full capacity production loads in metalizing larger items. Pump down time to attain a normal working pressure of 5×10^{-4} mm Hg is 5.5 minutes. A complete cycle, from inserting the work pieces into the vacuum chamber to removal of the coated item, has been made with polystyrene work pieces in 9 minutes. The operating range extends from 5×10^{-6} mm Hg to 2×10^{-3} mm Hg.

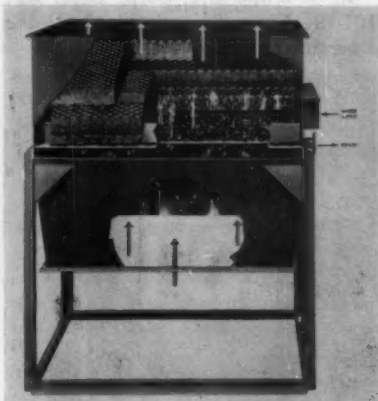
A planetary drive fixture contains

six rotating stations. Each of the six stations has six removable work-holding rods that may be adjusted along the length of each spoke of the station fixture to working diameters of from 2 to 20 inches.

The complete vacuum cycle is semi-automatically controlled by a four-po-



of a fluid-bed, polyethylene pad, into which water is introduced in counter flow to the air. The moving air causes a liquid level to be established in the polyethylene media and consequently provides a multitude of flooded contact surfaces for effective scrubbing. Excess water is forced to the sides of the elim-



inator section and thence downward to a drain pan. Normal water drain rate is three quarts per hour for each 1000 cfm. A secondary pad removes any mist that may have escaped entrapment in the fluid level pad.

The eliminator section of the unit is very light and compact, and is designed to handle high approach velocities. There is no liquid retention, and recirculating pumps are not required. Space and weight are thus held to a minimum.

Two basic designs are available. Design 2 has a nominal 2-inch pressure loss with low humidifying efficiency. Design 4 requires a 4-inch pressure drop to provide higher collection efficiency at nearly saturated exit condition.

The collector is available in seven sizes with capacities ranging from 1200 to 24,500 cfm. Exhaust fan and matching supports can also be provided. It is manufactured in hot-rolled or stainless steel, with polyvinylchloride or rubber coating also available.

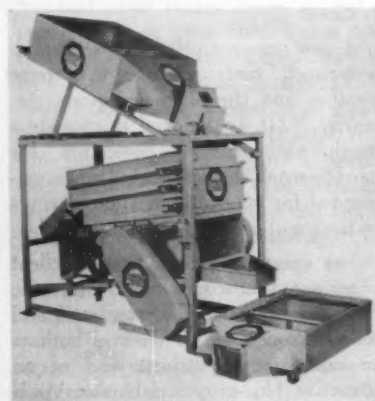
Chip Grader and Parts Separator

Esbac Barrel Finishing Corp., Dept. MF, 18 Beech St., Byram, Conn.

Vibra-Grader, the latest thing in high production parts separating and chip grading, operates on a totally different principle which gives many outstanding advantages.

The motion effectively prevents stones or parts from lodging in screen

openings. This results in the highest possible efficiency and greatest productivity at all times, also in far more



uniformity of grading than is possible by conventional methods. The motion upsets cup-like parts and prevents them from trapping media in which they have been processed. One, two or three screens may be used at one time.

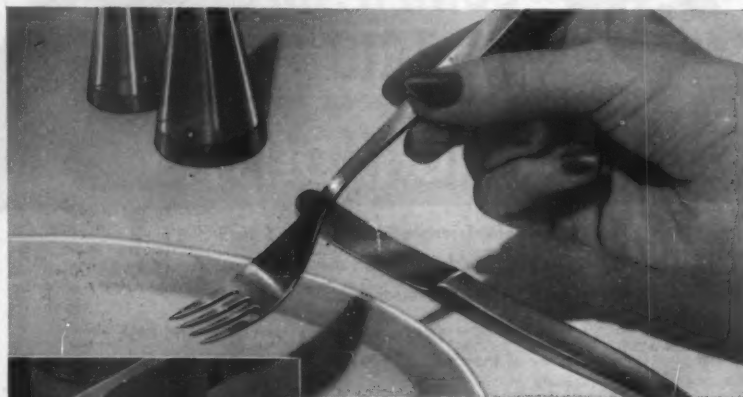
With three screens in use, it will make as many as four simultaneous separations. It can also be used to separate parts from chips and to size the chips at the same time. The unique action grades chips with the greatest rapidity; 2 to 3 tons per hour. It also avoids violent action which would nick or scratch parts.

The machine can be used with 1, 2 or 3 screens, which are quickly interchanged and are positively locked in position. A variable speed drive



For the finishing touch that means so much!

From the smooth feel of perfectly polished stainless steel tableware to the contoured grips on modern power tools, Jewel Brand Coated Abrasives are bringing fast, efficient grinding, smoothing and polishing to the manufacture of hundreds of products. Because end products cost less when you finish with Jewel Brand Abrasives, it will pay you to bring their many advantages to bear on your finishing problems. Order now from your Industrial Distributor or write for specific recommendations.



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ABRASIVE PRODUCTS, INC.
South Braintree 85, Massachusetts

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PLATING INDUSTRY

There's reason for Triangle Brand Copper Sulfate and Nickel Sulfate being close friends with the plating industry. Over the years they have proved their **DEPENDABILITY**.

Why? It's obvious — purity, uniformity, solubility and high conductivity of their solutions result in **quality plating**.

All-important "extras" found in the use of Triangle Brand Copper Sulfate and Nickel Sulfate yield long-life plating performance that **makes the difference**.

Insist on Triangle Brand Copper Sulfate and Nickel Sulfate for dependable plating baths.

And remember, Phelps Dodge is also a basic producer of
SELENIUM TELLURIUM



PHELPS DODGE REFINING CORP.

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changes the vibration to suit each individual job. Speed of feed from the hopper pan can be controlled to fit the job.

The load to be separated, or graded, is dumped into a hoist pan which is then placed in position on the frame. The screen gate of the hoist pan is then removed, allowing the load to flow into the feed chamber. From there, flow to the top screen is controlled by the feed gate. The speed of flow is controlled to produce the fastest rate of separation to suit the individual conditions. The unit is fully automatic. Once started, the operator is freed for other duties while the separation is being made.

One-Coat Metal Primer-Finish

Carter Paint Co., Dept. MF, Liberty, Indiana.

A new one-coat primer-finish for exterior metal surfaces subject to extreme weather and chemical conditions, Armorize MZD, is designed to provide a tough anti-corrosive protection for hard-to-reach surfaces. It is also recommended for applications where savings in time and labor are essential.

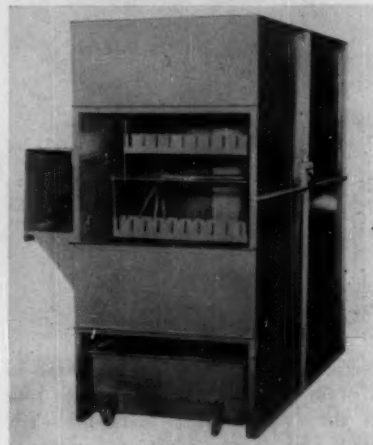
The paint is said to give excellent adhesion to new galvanized and zinc coated surfaces; to uncoated steel and other ferrous metals. It serves both as an anti-corrosive primer and as an attractive blue-gray finish coat. As a

primer only, it is an ideal bond for synthetic base finish coats.

By employing heavy metallic pigmentation, it provides a barrier against destructive electrochemical forces where dissimilar metals make contact.

Automatic Dipping Machine

R. G. White Mfg. Corp., Dept. MF, 101-18 Ninety-Seventh Ave., Ozone Park 16, N. Y.



A new automatic dipping and coating machine features enclosed operation for handling small parts on jigs or in baskets. It is equipped with explosion proof exhaust blower. An automatic timer starts and stops the trays for loading and unloading with adjustable time cycle. The unit is stated to eliminate a fire hazard where highly inflammable coatings are used.

Flatback Paper Tapes

Permacel, Dept. MF, New Brunswick, N. J.

Two new Hi-Temperature flatback paper pressure-sensitive tapes have been released for sale. The two tapes, EM 3979 Hi-Temp. Flatback Tape and EM 4082 Hi-Temp. Flexible Flatback Tape, have a specially compounded rubber-resin white adhesive mass.

Both have excellent high temperature and cold temperature resistance making them ideal for holding and masking during baking operations as well as high hold in cold storage and outdoor exposure.

Since both are odor free they can be used in enclosed areas. Another feature of these tapes is their stain resistant adhesive which permits application of the tapes on enamelled and lacquered surfaces without staining or discoloration.

The tapes can be used with auto-

matic dispensing machinery in high speed production line type operations. Positive holding characteristics insure that they will stay on the job.

Pore Sealer

Columbia Technical Corp., Dept. MF, 61-02 Thirty-First Ave., Woodside 77, N. Y.

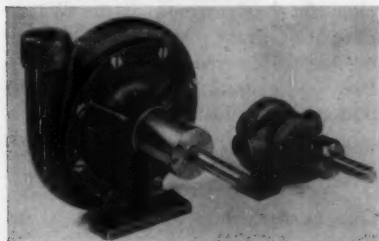
A new liquid resin for sealing small cavities, cracks and pores in metal surfaces, known as Impal, has a surface tension much lower than the capillary resistance of the smallest pores. Because of this physical property, it is claimed to penetrate pores and, after curing, forms a seal which resists acids, alkalies and saline atmosphere.

The resin prevents the spread of corrosion in cases of mechanical damage resulting in exposure of unprotected aluminum to air. A sealed surface is easy to keep clean since it is smooth. Moreover, sealed surfaces may be coated with any standard coating material or paint. The product is available in red, green, yellow, and in other colors to eliminate subsequent painting.

The resin does not affect the mechanical properties of the anodized aluminum or aluminum alloys on which it is used. A sealed surface contributes to a higher electrical resistance of the anodized layer and, depending on the thickness of the layer, upgrades the dielectric strength of the anodized surface up to 2,000 volts. It does not increase production costs because it replaces the customary hot water, steam, salt or wax treatment of anodized surfaces.

Stainless Steel Pumps

American Machine Products, Inc., Dept. MF, 172 Centre St., New York 13, N. Y.



New centrifugal and Neoprene impeller type pumps in stainless steel have sealed ball bearings, and their shafts, body and cover are made of acid-resisting Type 20 stainless steel. The stationary seats are of the same material and in addition, ceramic faced.



MODEL OP2

NOTE THESE FEATURES . . .

1. Unobstructed tank walls. Condensing coil and condensate pan are recessed providing superior vapor control, effective solvent reclamation and unobstructed working area.
2. Demand type water control. Insures using water only when needed, thereby reducing operating cost. Placement of nickel plated condensate coils in conjunction with new type water control eliminates water condensation along the side-walls of degreaser, thus, preventing rusting of the sidewalls and acid solvent, increasing the life of the degreaser.

- Will last twice as long!
- Reduce solvent costs 30% or more!
- Cut labor costs!
- Up to 40% less maintenance!

3. New pump design. All pump parts are fabricated of stainless steel. The rotor and end plates are nickel clad. Rotating magnetic field drives impeller, thus, the pump is completely sealed except the intake and outlet, preventing leakage.
4. Lower height. Working height reduced for easy operation.
5. Built-in storage tank. Holds adequate reserve for flushing in addition to entire contents of degreaser sump.
6. Less floor space. Designed to operate from either side.

SINCE 1923

CIRCO
EQUIPMENT COMPANY

122 Central Avenue, Clark (Rahway), New Jersey Offices in principal cities
PER-SOLV (Perchloroethylene) CIRCO-SOLV (Trichloroethylene)
Vapor and Ultrasonic Degreasers • Metal Parts Washers • Dryers • Solvent Recovery Still

OVER 208 STANDARD MODELS... including Circosonic ultrasonic degreasers. All backed by nation-wide technical field service.

YOUR INQUIRY BRINGS comprehensive 32-page vapor degreasing manual.

When caustics are to be pumped, Stellite seats can be supplied.

All mechanical seals are corrosion resistant, and rotary faces of either pure carbon or glass filled Teflon construction are available. Pumps may be used with motors from $\frac{1}{3}$ to 3 H.P. to deliver 56 g.p.m., no head to 75 g.p.m. with 90 ft. heads. Units have reinforced pipe ports of $1\frac{1}{4}$ " inlet and 1" outlet. The Neoprene impeller type units are self-priming and will pass small solids. These pumps are easy to take apart for servicing or inspection. Large carbon bearings are used to replace the conventional grease cups, and Buna-N "U" cup type seals eliminate stuffing box drag. Both are easily replaceable at low cost. Available in $\frac{1}{2}$ h.p. and 1

h.p. models rated at 10 and 25 g.p.m. respectively, these versatile pumps accommodate a temperature range from 35° to 150° and will handle a wide variety of materials.

Graphite Pumps

National Carbon Co., Dept. MF, 30 E. 42nd St., New York 17, N. Y.

Three new sizes of corrosion-resistant centrifugal pumps, two with nearly twice the capacity of present models, have been added to the line of Karbate impervious graphite pumps.

Known as models 22-FAL, 28-FAL, and 31-FAL, the new pumps are equipped with 1-, $1\frac{1}{2}$ -, and 2-hp, 1750-rpm motors. At this speed, the latter two types can deliver up to 150 gal-

Cincinnati

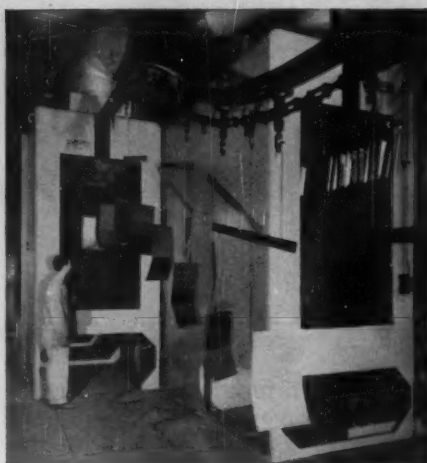
installed by

BRUNING

produces

- Savings in Material Handling
- Improved Product Quality
- Better Working Conditions

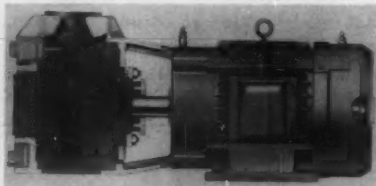
CLEANING AND FINISHING SYSTEM



Cincinnati Cleaning & Finishing Machinery is used in the production of a wide range of Bruning equipment for drafting and copying, earning the user's commendation for savings, improved product and working conditions.

The monorail cleaning machine shown here processes frame parts and cabinets of copying machines prior to finishing; it is also used to clean machined parts between operations. The cleaning machine is part of a complete Cincinnati system which also includes: dry-off oven, down-draft spray booth, paint bake oven, monorail conveyor and air make-up unit.

Use the engineering and experimental facilities of Cincinnati Cleaning to get more economical cleaning and finishing . . . with better results . . . in your plant. For details, write: Cincinnati Cleaning & Finishing Machinery Co., 2027 Hageman St., Cincinnati 41, Ohio.



lons per minute as compared to a top of 80 gpm for previous type F pumps.

The two larger pumps are available with 3-/or 5-hp motors for handling fluids of higher specific gravity than water. Maximum total head for each of the new types is 33, 51, and 67 feet, respectively.

The almost universal corrosion-resistance of impervious graphite makes these low-cost units ideal for a wide range of applications, and permits an

appreciable reduction in inventories through the standardization of pumps and replacement parts.

Portable Dumping Lifter

Special Products Div., Colson Corp.,
Dept. MF, Somerville, Mass.

A portable dumping lifter promises widespread application in handling of drums and other cylindrical objects. With 360 degree rotation and 90 degree tilt, this unit can grab, lift and dump drums of up to 55 gallon capacity and will lift rolls of up to 1,000 pounds. It is especially suited for unloading from trucks and double and triple-decking for storage. It will carry objects to processing, dump their contents and re-

turn container to storage for other disposition.

The unit has two separate hydraulic systems. Lifting is battery operated, with hand operation for clamping. Arm spreads are 18 to 38 inches in diameter, but the manufacturer will produce other spreads.

BUSINESS ITEMS

U. S. Time Honors Semberski For 30 Years' Service



Albert Semberski, general foreman in charge of all applied finishes and chemistry at U. S. Time's Little Rock plant was recently honored for 30 years of service with the company at a gala affair staged by the Foreman's Club of his city. Over 75 members of the club applauded the presentation of honors and a service pin by F. J. Orintas, plant manager.

Semberski joined U. S. Time July 19, 1928. Until 1954 he served as applied finishes foreman at the Waterbury-Middlebury plants, at which time he was transferred to the Little Rock Div., as general foreman. In addition to his duties there, he devotes a large part of his time as technical advisor to other branch plants.

Gumm Appoints Florida Distributor

Frederick Gumm Chemical Co. of Kearny, N. J., announces the appointment of S. & S. Chemical Co. for the Florida area. Their main office and warehouse is at 7220 N. W. First Court, Miami.

S. & S. will handle the complete line

of cleaning, deburring, burnishing, aluminum treating, and related compounds which have been in continual use in the metal finishing industry for many years.

The sales and service coverage resulting from this combination will provide industry in the area with a source of materials for all their needs.

Graver Announces Appointment of New Sales Representative

The appointment of *Crane Engineering Sales, Inc.* as exclusive engineering representative for most of the State of Wisconsin and the Northern Michigan Peninsula has been announced by *Graver Water Conditioning Co.* They are located at 1110 West Wisconsin Ave., Appleton, Wis., telephone RE-gent 3-4425. They will handle equipment for industrial and municipal water treatment, industrial waste treatment and chemical processing.

Founded twenty years ago by *H. C. Crane*, a registered professional engineer and a mechanical engineering graduate from Purdue University, the organization specializes in application engineering of industrial equipment. Assisting Mr. Crane are two graduate engineers from the University of Wisconsin, *R. L. Reetz*, Electrical Engineer and *B. O. Davis*, Mechanical Engineer.

Stevens Appoints New Sales Engineer

The appointment of *Darwin Chester* as sales engineer has been announced by *Frederic B. Stevens, Inc.* He has been a service engineer with the company since 1957. Prior to that time he spent 4½ years in a similar position with another Detroit metal finishing



Darwin Chester

equipment supplier. A native Detroit, Mr. Chester will represent the 76 year old concern in certain areas of Michigan and Ohio.

He is a member of the Detroit Chapter of the A.E.S. During World War II, he spent three years in the Air Force. He will make his headquarters at the firm's general office at 1800 18th St., Detroit.

Wheelabrator Appoints McCrory

Thomas S. McCrory has been appointed regional manager of *Wheelabrator Corp.*'s west coast sales organization. He will make his headquarters in Los Angeles, supervising the company's present Seattle, San Francisco, and Los Angeles territories.

Mr. McCrory served for 32 years in

the U. S. Navy and attained the rank of Lt. Commander. During this time he gained invaluable manufacturing and metal working experience at the Naval Gun Factory in Washington, D. C. and at the Naval Ordnance Plant in Charleston, South Carolina.

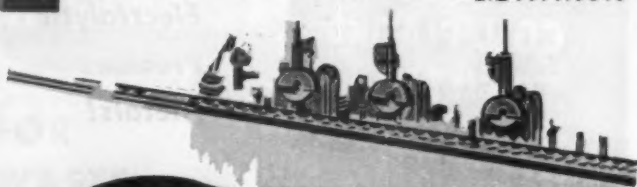
In 1952 he joined the Baldwin-Lima-Hamilton Corporation as a sales engineer. He was western sales manager of their Niles Tool Division before joining Wheelabrator.

Lupoline To Expand

Joseph Lupo, president and general manager of *Lupoline Automatic Polishing Equip. Corp.*, has left for an extensive trip to Europe to personally investigate the metal and plastics finishing in England, France and Italy. In

Type 190

FABRIC ENGINEERED by *Milliken*



THE
INDUSTRY'S
Standard
FABRIC

"Type 190" is today the most widely used cloth in buffing. Engineered by Milliken

Research for "cut and color" work,

"Type 190" has become the work horse of every buffing shop. This versatile cloth has a superior wear life with that "just right stiffness," a combination which adds up to a very favorable buff/cost performance ratio. Check this for yourself.

"Type 190" is now available as a trademarked fabric... as are the other three fabrics that make up the present line of Milliken "Fabrics Engineered for Buffs". Because each of these fabrics has different buffing characteristics, we suggest that you try out all four. Ask your buff supplier to make up a test lot of buffs in the styles and sizes you use. You will know you are getting a premium quality fabric because the trademark appears in the plies of each section.



DEERING, MILLIKEN & Co., Inc.

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DAVIS-K GOLD PLATING SOLUTIONS

... LEADER in
Electrolytic
Precious
Metals!

ONE OPERATION Antique Gold Solution

ONE OPERATION French Grey Solution

A Rich French Grey that Improves Quality and Costs Less!

OTHER DAVIS-K PRODUCTS:

- HARD GOLD SOLUTION for Printed Circuits and Electronic Parts
- POTASSIUM GOLD CYANIDE SALTS
- LUSTROUS WHITE RHODIUM SOLUTION
- Variable-type Tank Rheostats, specially designed for precious metal plating.

ALL DAVIS-K GOLD PLATING SOLUTIONS ARE:

- Made in all colors
- Bottled by Troy Weight
- Color constant
- Made from assayed US Treasury Gold only
- Tarnish-resistant
- Ready for immediate use
- Brilliant in finish

We are fully equipped to reclaim old gold and rhodium solutions. No charge for small sample plating.

Write Dept. MP for details.

FREE
Consultative Service
Call on Davis-K
process engineers
for help with your
special plating prob-
lems and installa-
tions.



"Where Glittering Elegance Reflects Lasting Quality."

DAVIS-K
PRODUCTS, CO.

135 West 29th St., New York 1, N. Y.
(Ongene 4-1978 V)

line with the firm's new expansion and development program, Mr. Lupo will check the European markets and it is their intention to establish a research laboratory and manufacturing plant in a principal city.

Gulton Names Assistant to the President

Appointment of J. Paul Jordan as assistant to the president has been announced by Gulton Industries, Inc. He joins the company in the capacity of a scientific coordinator, responsible for technical planning on government and company sponsored programs.

Mr. Jordan received his bachelor of science degree in Electrical Engineering from the University of Pennsyl-

vania in 1937, and completed numerous graduate courses at Union College and Syracuse University. In addition, he taught several courses in electronic theory at Union College for more than five years.

During his employment with the General Electric Company, over the past 20 years, Jordan specialized in electronics and physics and served as a consulting engineer; manager, physical electronics section; section engineer and special assignments engineer.

Jordan is the author of numerous technical papers including university text books, and has had six patents issued as a result of his work. He is currently vice chairman of the Standards and Electronics Committees, AIEE and



J. Paul Jordan

membership chairman of Professional Group on Election Devices, IRE.

Lehmann Joins Universal Paint & Varnish

Universal Paint & Varnish, Inc., Bedford, Ohio, announces the appointment of Albert F. Lehmann to its sales staff. Mr. Lehmann received his Bachelor of Science degree at Ohio State University. His experience in the sales and technical phases of the industrial paint field was gained at The Glidden Co. and Kish Industries.

American Air Filter Announces Additions to Field Sales Offices

Six additions to its field sales organization have been announced by American Air Filter Co., Inc.

Raymond J. Dunn has joined the Shreveport, La., office of the firm's representative there, Richard L. Johnson.

Don Ryan, formerly with Kennard Corp. (an AAF subsidiary), St. Louis, Mo., has joined Air Filter & Equipment Co., Chicago, as a sales engineer, as have Tom Mulvey and Larry Harlan.

Edward A. Cruse has joined the Detroit branch office as a sales engineer.

Harold Bee, formerly with Kennard Corp., has joined the staff of Rush Company, Kansas City representative.

Nuodex Products Co. Expands Nickel Salts Production

Expansion of production facilities for nickel catalyst and plating salts has been completed by Nuodex Products Co., a division of Heyden Newport Chem. Corp.

The nickel salts product line now includes nickel sulphate, nickel chloride,

nickel formate, nickel carbonate, nickel nitrate and nickel acetate. A basic position in a complete line of cobalt salts complements this product array.

Binks Adds Electrostatic Finishing to Spray Painting School Curriculum

Rounding out the course of instruction at its spray painting school to cover all aspects of industrial finishing, Binks Mfg. Co. has added instruction in electrostatic spray finishing.

In the new electrostatic course students will have an opportunity to actually set up and operate an electrostatic system using the most modern equipment available. They will learn power requirements for such a system, optimum air and material pressures, gun positions and what products are best suited for electrostatic finishing. In addition, they will be taught general theory behind the technique.

The spray painting school sessions are held every month of the year except July and August. The fall schedule for the school includes a session for industrial jobbers in September and open sessions October 6-10, November 3-7 and December 8-12. The school is open on a tuition-free basis to all interested members of the finishing industry.

Metalwash Appoints Cleveland Representative

C. Berton Persons has been appointed representative for the Industrial Division, Metalwash Machinery Corp., Elizabeth, N. J., manufacturers of finishing systems for the metal products manufacturing industry. In his newly created post, Mr. Persons will represent the company in the rapidly growing greater Cleveland market area.

Mr. Persons has a broad background



C. Berton Persons

of executive sales and engineering experience with leading firms in the metal products industry. He is a licensed Professional Engineer in the State of Ohio, and a member of the National, Ohio and Cleveland Societies of Professional Engineers.

Troy Plating Works in New Location

Effective September 1, 1958, Troy Plating Works, Inc., of Chicago, Ill., moved to new quarters at 514 South Laflin St. The move from the company's old headquarters at 2033 North Halsted after a period of approximate-

ly two years was necessitated by the need for expanded capacity and increased facilities.

The new plant occupies 7,800 square feet of floor space. In its new home, the metal firm will also incorporate metal fabricating, including stamping and tube bending, as a new feature of its operations.

Fully equipped with high speed metal plating processes, the company specializes in finishing copper, nickel, chromium, brass, bronze, gold, silver, lacquering, polishing and buffing, satin and oxidized finishes and paint fill and masking.

A member of the Chicago Electro-

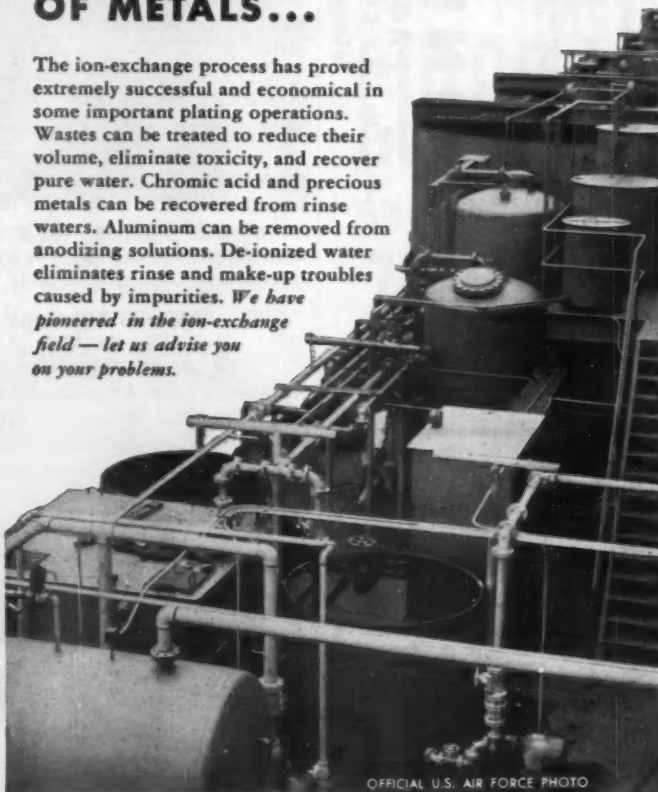
ILLINOIS WATER TREATMENT CO.
840 CEDAR ST., ROCKFORD, ILL.
CANADIAN DIST.: Pumps & Softeners, Ltd., London, Ont.
NEW YORK OFFICE: 141 E. 44th St., New York 17, N.Y.

ILLCO-WAY

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FOR WASTE TREATMENT AND RECOVERY OF METALS...

The ion-exchange process has proved extremely successful and economical in some important plating operations. Wastes can be treated to reduce their volume, eliminate toxicity, and recover pure water. Chromic acid and precious metals can be recovered from rinse waters. Aluminum can be removed from anodizing solutions. De-ionized water eliminates rinse and make-up troubles caused by impurities. *We have pioneered in the ion-exchange field — let us advise you on your problems.*



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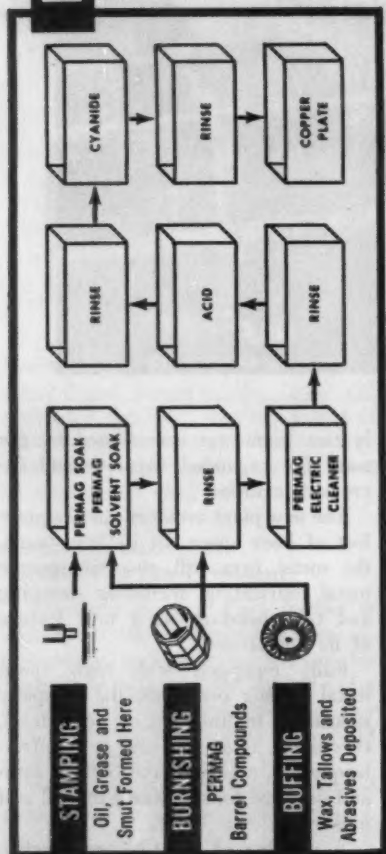
PERMAG FOR EFFICIENT METAL CLEANING

Your most difficult metal cleaning jobs can be solved through our practical knowledge and long experience. PERMAG technical, shop-trained representatives are ready to make a service visit—write today, no obligation. FREE — send for this handy, vest-pocket electroplater's cleaning manual... it's yours for the asking.



MAGNUSON

PRODUCTS CORPORATION
Executive Offices: 50 COURT ST., BROOKLYN 1, N. Y.
In Canada: Canadian PERMAG Products, Ltd., Montreal



platers Institute, Alex F. Cardenas is the firm's president, credited with over 35 years of experience in the metal finishing industry.

Infilco Expands Facilities and Services; Promotes Three

Indicative of the improvement in business prospects throughout industrial and municipal fields and the growing activities of the company, major moves to increase facilities in sales and service have just been announced by *Infilco Inc.*, manufacturers of water, sewage and waste treating equipment, with headquarters in Tucson, Ariz.

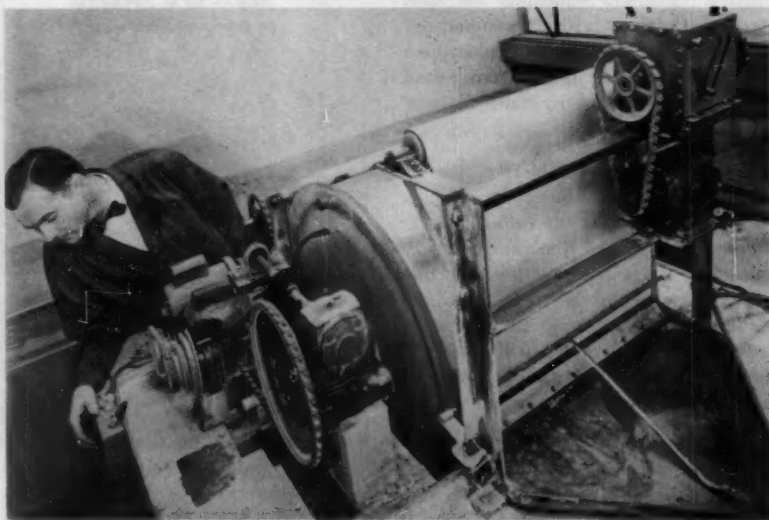
C. T. VanderMolen has been appointed to the position of assistant sales manager with direct supervision of the activities of the sales engineering department of the company. With a background of 28 years with the firm, including 10 years in sales and management capacities, Mr. VanderMolen

brings a wealth of experience and an extremely successful record to his new position.

H. W. Frazer, formerly manager of the Demineralization Division, has been promoted to the new position of industrial project manager. In this capacity, he will have supervision of the sales engineering and project activities of the industrial water, industrial waste, demineralization, metallurgical, pulp and paper and beverage divisions of the company.

A new Project Engineering Department has been organized to provide additional facilities for customer service. The new department will be under the direction of L. H. Piper, for many years head of the estimating department. It will provide assistance to both the sales engineering and production engineering departments on the technical aspects and scheduling of projects, including contact with customers and their engineers and contractors.

Asarco Develops New Process to Make Zinc Foil



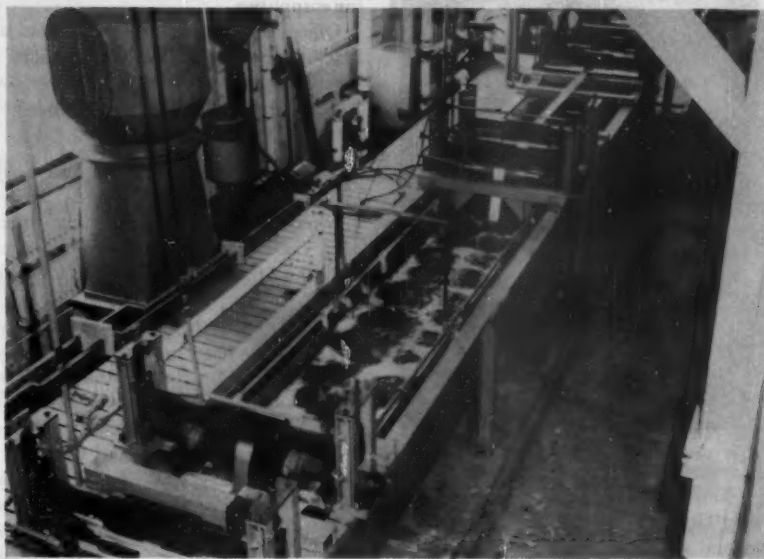
A new, continuous process to produce zinc as a thin foil has been developed by *American Smelting and Refining Co.* at its central research laboratory, South Plainfield, N. J. A pilot plant unit is now turning out developmental quantities of the foil in sheets ranging from 0.005" to 0.001" thickness, and 26" in width.

In the new method, zinc is deposited electrolytically from a zinc sulfate bath onto a revolving drum. The foil is stripped from the drum in a continuous sheet of uniform thickness. This electrolytic process is said to be more eco-

nomical than the older, conventional metal rolling techniques, and to produce foil of high chemical purity and with unique ductility and tensile strength. Unlike some other metallic foils, zinc foil can be easily soldered, and can be printed on.

The new foil will sell at a lower price per square foot than copper foils. When in commercial production, the zinc foil will probably be cheaper than comparable aluminum foil. Asarco is now contemplating the installation of a larger scale pilot unit at its Corpus Christi, Texas, plant.

H-VW-M Sets Up New Test Line for Continuous Strip Work



A new test line for solution of problems in continuous high-speed strip anodizing, sealing and dyeing processes has been set up by *Hanson-Van Winkle-Munning Co.* The facility was built to satisfy a growing demand for anodized aluminum strip to be used subsequently for fabrication.

It is designed also for study of problems in the electroplating, etching, cleaning, pickling and other industrial process requirements for high speed continuous treatments.

Glidden Co. Establishes New Research and Development Laboratory

Establishment of a new plastics research and development laboratory in Cleveland has been announced by the *Glidden Co.* Located at the firm's Paint Division Research Center at 12430 Elmwood Ave., the new plastics laboratory becomes part of an over-all company effort to centralize all research and development work on new products. Integrated with other research groups of the paint division, the combined groups will utilize the increasing similarities of paint and plastics to improve both lines of products.

The new laboratory, which will be staffed by personnel who were formerly engaged in plastics research at the regional laboratories, will be under the supervision of *Dr. H. J. Kiefer*, coordinator of research.

Industrial Electroplating Laboratories Expands

Industrial Electroplating Labora-

tories, of Fair Lawn, N. J., has recently expanded its facilities and personnel. The laboratory will now be able to offer its clients salt spray and humidity tests, X-ray and hardness tests, plus many other metallurgical, electrical, and chemical tests. *Hertha Chary*, plating chemist, will give part-time assistance. *Fred Kohler*, consulting chemical engineer, will assist part-time on electrical and design problems, and *Max Birnbaum*, chemical engineer will assist part-time on organic chemical problems as well as in plant design.

Services of the Graver Water Conditioning Co., New York, have been expanded by the regrouping of major sales areas and the formation of new departments. The new sales structure announced by the company covers the following fields: industrial, municipal and utility water treatment; industrial waste treatment; chemical processing; foreign operations, and process en-

Graver Water Conditioning Expands Operations

Services of the Graver Water Conditioning Co., New York, have been expanded by the regrouping of major sales areas and the formation of new departments. The new sales structure announced by the company covers the following fields: industrial, municipal and utility water treatment; industrial waste treatment; chemical processing; foreign operations, and process en-

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At long last you can now secure beautifully bright, gleaming colors from a simple LUSTER-ON chromate dip process for your zinc plated small parts.

These are not just spotty identification colors. These are scintillating golds, yellows, blues, greens, violets, reds, brass and copper hues that will add glamor and sales appeal.

Especially Brilliant on Wire Goods

Be the first in your field to offer this sales booster. Write or wire today for the full story on low-cost LUSTER-ON COLOR.

Samples Gladly Processed Free

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Robert Dvorin

gineering. Managers have been named for each of them.

The new managers and the posts they will hold are as follows: *George Apfel*, Process Engineering; *N. S. Chamberlin*, Chemical Processing; *J. D. Crell*, Foreign Operations; *Robert Dvorin*, Industrial Waste Treatment; *E. A. Strahlendorf*, Industrial Water Treatment; *R. S. Lewis*, Sales Promotion.

Shutts Elected Executive at Hartford Ball

Hartford Steel Ball Co., Inc., manufacturers of precision balls and custom bearings, has announced the election of *Emmett N. Shutts* as executive vice-president. He succeeds the late *Stephen V. Zavoico* as operating head of the company.

Mr. Shutts joined the firm in 1950



Emmett N. Shutts

as New England sales representative. In 1956 he was appointed assistant general sales manager. Early this year he was elected a vice-president. In the latter capacity, he directed the company sales and nationwide field sales organization.

Keystone Plating Supply, Inc. Formed

A new company, *Keystone Plating Supply Inc.*, has been formed to serve the metal finishing industry in Michigan. *Jack E. Keyes* and *Henry V. Pfeuffer*, founders and co-owners, are former sales executives of *Wagner Brothers Inc.*, Detroit.

Among the products offered by the company are Churchill buffs; Promat zinc and cadmium addition agents and conversion coatings; Grav-i-Flow tumb-

ling materials; anodes and other finishing supplies.

Offices and warehouse are located at 21039 Dequindre, Hazel Park, Mich.

Binks Moves New York Office to New Quarters

To improve the company's New York export facilities and provide larger quarters for its factory branch, *Binks Mfg. Co.* has moved to a newer, larger building at 35-42 41st St., Long Island City 1, N. Y.

According to the company, the move will provide more up-to-date facilities and more room for warehouse and service departments. The company's New York office was formerly located on 41st Ave. in Long Island City.

Approximately 9,000 feet of a total of 10,000 square feet at the new location will be used for warehouse and service while the remaining space will be used for various offices.

Amchem Products Appoints Price

Amchem Products, Inc., formerly *American Chemical Paint Co.*, announces the appointment of *Jack M. Price* as assistant sales manager, Metalworking Chemicals Division. Price will assist in the operation of the central sales office and in the direction of the central staff and field sales activities.

Price originally joined the firm as a sales representative in the New Eng-



Jack M. Price

land territory. In 1954 he was appointed assistant manager, Eastern District and moved to the home office in Ambler. In May 1956 he was transferred to the central sales staff, also in Ambler, as assistant to the sales manager.

DEPENDABLE

PPi

PRODUCTS

PLATING RACKS
RUBBER DRUM
LINERS
ACID CONTAINERS
ANODE HOOKS
FIBERGLASS TANKS
DUCTS & HOODS
PLASTIC COATED
DIPPERS & PAILS
STEEL & STAINLESS
STEEL TANKS
LEAD & PLASTIC
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POLYETHYLENE
PAILS &
CONTAINERS
FUME SEPARATORS
PLATE COILS
LEAD ANODES
DEGREASING
SOLVENTS
SILVER
BRIGHTENER

DURABLE and INEXPENSIVE EXPANDED METAL BASKETS PLAIN or PLASTISOL COATED

- Cheaper Than Monel or Stainless Steel
- Ideal for Pickling, Plating, or Centrifugal Drying of Small Parts
- Extra Long Dependable Production Life

Rugged construction . . . Expanded metal sides, perforated bottoms, reinforced welded steel frames, with stainless steel ball and brackets. Baskets supplied Plastisol coated or uncoated.



Wide Choice of Types and Sizes to Fit Your Needs . . .

Stock No.	Dia.	Depth	Exp. Mtl.	Ga.	Price (uncoated)	Price (coated)
XB100	11 1/2"	12"	1/4"	18	\$14.95	\$22.50
XB101	11 1/2"	12"	1/2"	13	14.95	22.50
XB200	11 1/2"	15"	1/4"	18	15.95	23.50
XB201	11 1/2"	15"	1/2"	13	15.95	23.50
XB300	15"	20"	1/4"	18	24.00	34.50
XB301	15"	20"	1/2"	13	24.00	34.50

Above sizes are before Plastisol Coating

Orders Filled Promptly . . . PLACE YOUR ORDER TODAY



PRODUCTS, Inc.

1509 N. WASHINGTON
KOKOMO, INDIANA

Casalbi Co. Appoints Distributor

The Casalbi Co., Jackson, Mich., has announced the appointment of *Finishing Equipment and Supply Co.*, 3702 E. Lake St., Minneapolis 6, Minn., as a distributor for that area. They will handle the complete line of Globe barrel finishing equipment and supplies.

Finishing Equipment and Supply Co. is a newly formed organization specializing in the finishing field. *Win Sabatka* and *William Bloomquist* are the owners. Mr. Sabatka was previously associated with the E. R. Frost Co.; Mr. Bloomquist has had 20 years of production and engineering experience.

Little Joins Incar, Inc.

Jack D. Little has joined *Incar, Inc.* of Cleveland, Ohio, as vice president — sales. He was formerly associated with the McGean Chemical Co. as manager of technical sales. Prior to his association with McGean Mr. Little served Harshaw Chemical Co. in various capacities as manager of technical service, manager of technical sales and assistant manager of research and development. Mr. Little holds many patents in the electroplating field.

Industrial Chemical and Supply Appoints Witt



George Witt

Industrial Chemical and Supply Co., Tampa, Fla., has appointed *George Witt* as Florida state sales supervisor. Witt and family have moved to Tampa from Cincinnati, where he was associated with Diamond Alkali Co. for the past ten years.

ENTHONE HOLDS SALES CONFERENCE



Enthone's management personnel and sales engineers at recent sales conference: (front row, l. to r.) F. A. Schneiders, R. B. Goodsell, L. J. Durney, D. S. Hartshorn, J. E. Rhoads, J. R. Eisele, W. K. Murray, L. V. Gagnon, E. B. Washburn; (back row, l. to r.) P. L. Veit, A. F. Fletcher, A. H. Sanders, A. R. Tefft, H. M. Goldman, Dr. A. J. Phillips, Director of Research, ASARCO, Dr. W. R. Meyer, President, L. J. Molnar, C. C. Helmle, V.P., Sales, A. J. Kolb, J. H. Shockcor, D. F. Seymour, L. H. Butcher Company, C. Schaefer.

Polymer Corp. Names Distributor

Commercial Plastics & Supply Corp. of New York City has been named an authorized distributor for nylon products manufactured by the *Polymer Corp.* of Reading, Penna. Commercial will stock and service the metropolitan New York area, including part of Connecticut and New Jersey. Nylon products to be handled by Commercial will include rod, square rod, plate, sheeting, tubular bar, strips, tapes and pressure tubing.

Commercial has sales and warehouse

operations as well in Pittsburgh, Pa., Miami, Fla., Greensboro, N. C. and Newark, N. J. In stocks available and in volume of plastics materials moved, it is the largest distributor serving the Eastern Region.

Comco Plastics, Inc., its well-known fabricating subsidiary, is located in Ozone Park, Long Island.

J. D. MacKenzie Elected Asarco Board Chairman

John D. MacKenzie has been elected chairman of the board of *American Smelting and Refining Co.*, to fill the vacancy caused by the death of the late

**Whatever your
Cleaning or Processing
Problem . . .**

Write to A-F FIRST!



A-F thrives on the "tough" jobs!

Example: *Thirteen* separate cleaning and processing operations are performed on hermetically sealed containers by the completely A-F co-ordinated system partially shown above.

Whatever the size and shape of *your* metal part or product — whatever your cleaning or finishing problem—A-F can provide the proper equipment, be it a standard-type A-F machine or an A-F completely co-ordinated job-engineered system.

Write TODAY for free 28-page brochure

A-F ENGINEERED Cleaning and Finishing Machines
Plant-Wide Conveying Systems
Pre-Engineered Conveyors—Rollers, Wheel, Belt, Trolley



THE ALVEY-FERGUSON CO., 504 Disney St., CINCINNATI 9, OHIO and Azusa, California



J. D. MacKenzie

Kenneth C. Brownell. Mr. MacKenzie will continue as president of the company.

A native of Pembina County, N. D., Mr. MacKenzie joined the firm in 1920 as a chemist at the Garfield, Utah, smelter. He rose through the ranks to become vice president in charge of smelting operations in 1948, and was elected a director in 1949. He became president of the company last April.

Mr. MacKenzie also serves as a director of Revere Copper and Brass, Inc., General Cable Corp., Southern Peru Copper Corp. and Western Phosphates, Inc. He is a member of the executive committee of Revere and General Cable.

Division of U. S. Hoffman Machinery Corp. Moves

The Industrial Filtration Division of the U. S. Hoffman Machinery Corp., has been transferred to Syracuse, N. Y.

All inquiries regarding filtration equipment should be sent to the firm at Thompson Road Plant No. 1, Syracuse, N. Y.

Pangborn Appoints Milkie Chicago District Manager

A. A. Milkie has been appointed manager of the Chicago district of the Pangborn Corporation, Hagerstown, Md., manufacturers of abrasives, blast cleaning and dust control equipment for the machinery and metal working industry.

Mr. Milkie has served with the firm as a sales engineer in the Chicago district since 1951 and in his new posi-

tion will direct extensive field engineering service and staff of sales personnel. His headquarters will be at 2435 North Halstead St., Chicago, Ill.

Mr. Milkie received his bachelor's degree in Mechanical Engineering from the Clarkson College of Technology and is a member of ASME, American Foundrymen's Ass'n. and the Blast Furnace and Coke Oven Ass'n.



A. A. Milkie



NUGLU

THE IDEAL ADHESIVE

For Setting Up or Recoating
Polishing Wheels, Abrasive
Belts & Discs

Nuglu, a liquid glue, developed to lengthen wheel life — produce a better finish, and increase metal finishing production.

BRUSHING NUGLU

A mixture of Nuglu and graded aluminum oxide grain —

Save on operating costs, increase production, reduce wheel inventories, and obtain greater results, with less costly materials, in fine polishing work!

Ask for information on The Siefen Finishing Systems

— Also for better metal finishing use Siefen Compositions • Stainless Steel • Bar (Grease) in Tube • Liquid Tripoli • Liquid Grease • Lapping Compound • Burring Compound.

Siefen For Service

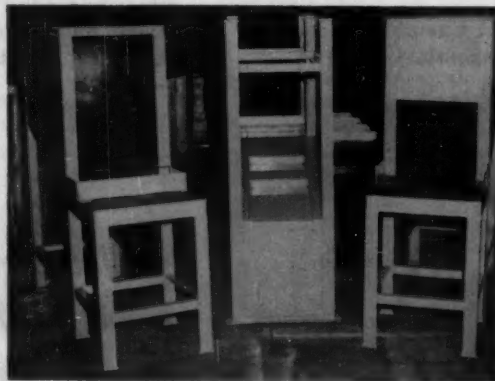
J. J. SIEFEN CO.

5643 LAUDERDALE, DETROIT, MICH.

*1927

Our Thirty-First Year

1958*



All Guesswork Eliminated

When you specify Stortswelding for production equipment, you can depend on it that every piece will fit precisely into your production line — exactly as you planned it. What's more, it will stay that way — because all welds by Storts are strongpoints.



38 Stone Street
MERIDEN, CONN.

Manufacturers of Welded Fabrications to Specification

Promat Appoints Miller

Promat Div., Poor & Co., announces the appointment of *Russell Miller* as its new director of research. Before joining the firm he was in charge of buffing, polishing and plating units at the Central Div. of Stewart-Warner.

Mr. Miller, whose interest lies in the practical and economical application of new and better products for metallic



Russell Miller

preparation and finishing, is a graduate of the Illinois Institute of Technology, where he majored in Chemical Engineering.

Both the firm and its customers will benefit greatly from Mr. Miller's experience in the plating field.

Industrial Instruments Purchases Mosher Electronic Controls

Industrial Instruments Inc. has announced that they have recently purchased outright *Mosher Electronic Controls*, 72 Vine St., Larchmont, N. Y. Industrial has manufactured these controllers for some time with Mosher specializing in the applications engineering and sales. With the acquisition, the company will now handle all aspects of the operation.

Neilson Appoints Izzett to New Post

Neilson Chemical Co., 2300 Gainsboro, Detroit, manufacturers of products for phosphate coating, cleaning and preparing metals for painting, announce the appointment of *Robert Izzett* as midwestern regional sales manager. In this new capacity he will supervise sales activities in the States of



Robert Izzett

Iowa, Illinois, Wisconsin, Minnesota and Northern Indiana.

Mr. Izzett has been associated with the company for the past 15 years; this service combined with his previous years of experience in the metal finishing field makes him eminently qualified for this position. He will be ably assisted in his new duties by *Willis J. Stoddard* of Chicago and *Charles R. Woessner* of Milwaukee.

UNIVERTICAL "PHOSPHOR-BRITE" Rolled COPPER ANODES for Acid Baths



SINCE 1939

VIRGIN METALS USED EXCLUSIVELY

UNIVERTICAL
FOUNDRY AND MACHINE COMPANY
14841 Meyers Rd., Broadway 3-2000, Detroit 27, Mich.

Producers of Rolled — Cast
and Forged High Purity
Anodes — Nickel — Copper — Zinc — Tin — Lead
— Cadmium and Brass.

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THIS IS SERVICE PLUS! DALLAS, TEXAS PHONED!

A rush order on a Saturday morning. Shipment arrived in Dallas 48 hours later on Monday morning. This is a typical case of Service Plus.

**AGATE LACQUER
MANUFACTURING CO., INC.**

SERVING INDUSTRY SINCE 1927

11-13 43rd Road
Long Island City, N. Y.
Stilwell 4-0660 - 1

AGATEEN!

THE LAST WORD IN QUALITY

National Lead Appoints Ruppert

Philip W. Ruppert has been appointed manager, metal division, for the Atlantic Branch of *National Lead Co.*, succeeding *George Sathre*. Mr. Ruppert continues as assistant manager of the company's metal department. *Russell C. Kleinecke* becomes manager, metal division, *National Lead Co. of Massachusetts*, replacing *George*



Philip W. Ruppert

A. Savage, who has retired after twenty-five years of service.

Mr. Ruppert has been assistant manager of the metal department since 1951. He started with the company in 1929 as an auditor, becoming assistant manager of *American Lead Corp.*, a subsidiary, in 1935 at Indianapolis. Two years later he was transferred to the Chicago branch where he became assistant manager in 1949. He is a graduate of the University of Wisconsin.

Mr. Savage has been manager, metal division, *National Lead Co. of Massachusetts*, since the division was formed in 1949. He began his company career in 1933 with *E. W. Blatchford Co.* and was its New England representative for 11 years.

Mr. Kleinecke began his employment with the company in 1941 at the Cleveland branch. In the following year he was placed in charge of metal sales. He became assistant to the manager of the branch's metal division in 1954, with headquarters in Pittsburgh. He was transferred to the Atlantic branch as assistant to the manager, metal division, in January of last year.

Eclipse Air Brush Promotes James L. Whalen

The promotion of *James L. Whalen* to vice-president and sales manager has been announced by *Eclipse Air Brush Co.*, manufacturers of spray equipment since 1908.

Mr. Whalen has been associated with the firm for more than eleven years. He has been sales manager since 1954.



James L. Whalen

TAKE THE LOAD OFF YOUR TOP BRASS



USE TRUE BRITE BRASS SOLUTIONS

Trouble Free — Low Cost
Little Supervision Needed
Ready To Use — Just Add Water
Uniform Color — Can Match Colors

Write For Bulletin on Brass Plating

TRUE BRITE CHEMICAL PRODUCTS CO.
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PAINT STRIPPING CLINIC!

Send Us Your Tough Stripping Problems for Fast Action!



10 YEARS OF BECK PAINT STRIPPING CLINICAL SERVICE Saves Thousands of \$\$\$ for Customers—Who Now Use World-Famous...

EPOXYSTRIP

Better find out for yourself . . . about *Epoxystrip*, *Econostrip* and other Beck Paint Remover lines and formulations. Use the **BECK CLINIC SERVICE**—send us several parts, sections, or test panels (properly tagged) of the work to be stripped.

Write or 'phone giving us essential information—your problem details, requirements, tanks available, hot or cold, etc. This service, and our prompt report, are free, with no obligation.

Beck Strippers outstrip all others—removing organic finishes, epoxies, etc., as easily as baked enamels, lacquers, etc. No stripping scum—clean rinsing!

SEND FOR FREE BROCHURE



BECK EQUIPMENT COMPANY
3350 WEST 137th STREET — CLEVELAND II, OHIO

For seven years previously Mr. Whalen handled sales in New England, where he became the top ranking salesman.

Currently living in Madison, N. J., Mr. Whalen attended New Jersey schools and the University of Virginia, and is a veteran of World War II where he spent 22 months overseas with the 505th Parachute Regiment.

Magnuson Transfers Oates

Magnuson Products Corp., manu-



Clifford Oates

facturer of specialized chemical cleaning compounds, announces the transfer of its technical representative *Cilford Oates*, to the Conn. area, excluding Fairfield County.

Mr. Oates is a skilled and experienced man, with many years of metal finishing experience in the electroplating industry. In his new territory he will be sales and service representative for the firm's full line.

Hubbard-Hall Chemical Co. Acquires Control of Chem-Salts, Inc.

Hubbard-Hall Chem. Co., Waterbury, Conn., has announced the purchase of the majority interest in the firm of *Chem-Salts, Inc.*, of Atlanta, Ga., formerly *Metalsalts Chemicals, Inc.*, manufacturers of metallic chlorides and copper cyanide. *Abner A. Towers*, president of Metalsalts, will remain as president of the newly named firm, with *Edward R. Jones*, also executive vice president of Hubbard-Hall, as vice president. *Charles T. Kellogg*, treasurer of *Connecticut Chlorine Products*, a wholly owned sub-

sidary of Hubbard-Hall, will be secretary and treasurer of Chem-Salts.

Hubbard-Hall, which was founded in Waterbury in 1849 as a drug store known as *The Apothecaries Hall Co.*, received its new name on January 1, 1957, when three New England fertilizer manufacturers and agricultural chemical distributors were merged into *The Apothecaries Hall Co.*



Abner A. Towers



CLOTH BUFFS

ZIPPO

- High Count, Heavy Duty, Bias-cut Cloth.
- Extra folds provide wider buff face and greater compound holding capacity.

FORMAX BUFFS—These famous fast cutting and long wearing buffs continue to set the standard of performance for bias-type cloth buffs. You can depend on uniform quality from shipment to shipment.

Write for Descriptive Literature

FORMAX MFG. CORP.

DETROIT 7, MICHIGAN

"THE FOUR McALEERS"

- Ventilated Steel Centers.
- Perfectly balanced sections require no raking.

Drying time **CUT IN HALF!** with...

Model 20 New Holland **KREIDER** Centrifugal Dryer

Air-Dries . . . as it Spin-Dries. Gives smooth, moisture-free surfaces without scoring or marring . . . assures faster production . . . saves money wasted on "rejects."

SPECIFICATIONS:

1 hp motor—220, 440, 550 volts—2- or 3-phase. Spins 75-lb. loads at 825 rpm. Quiet V-belt drive. Arc-welded, steel-plate construction. Weight 490 lbs. Minimum floor space. Meets N.E.C. specs. Auxiliary electric or steam units available as optional equipment.



Send for illustrated 4-page folder.
Address: Department MF-1058



NEW HOLLAND MACHINE COMPANY
NEW HOLLAND, PA.

Chem-Salts Inc., will continue to operate from its office and plant in Atlanta, Ga.

Narda Ultrasonics Establishes West Coast Sales Region

The appointment of *Eugene Fioramonti* as western regional sales manager is announced by *The Narda Ul-*



E. Fioramonti

trasonics Corp., Westbury, N. Y. In this capacity, he will direct and coordinate the sales activities of a group of distributors and representatives. A sales office and warehouse will be established in Los Angeles in order to afford west coast companies the advantage of locally stocked ultrasonic cleaners, on the spot technical assistance, and more intimate service.

A pioneer in the field of ultrasonic research, and product and market development, Mr. Fioramonti was formerly associated with the Bendix Aviation Corp. and the Curtiss-Wright Corp.

Carr Joins Stevens

Ernest D. Carr has been appointed a sales engineer in the *Metal Finishing Division of Frederic B. Stevens, Inc.* of Detroit. Mr. Carr will represent the firm, a leading manufacturer of metal finishing equipment and supplies in Maine, Vermont, Massachusetts, Rhode Island and New Hampshire. He will make his headquarters at the company branch in New Haven, Conn.

Prior to joining Stevens, Mr. Carr spent seven years as a sales engineer for a well known distributor of electroplating supplies located in Cambridge, Mass. During World War II he put in five years with the U. S. Army, seeing overseas service in both Europe and Asia. He has attended M. I. T. and is a member of the A. E. S.

Lee Named Field Engineer for Zolatone

Appointment of *Morton A. Lee*, materials and process engineer, to the position of field engineer has been announced by *Zolatone Process, Inc.* He will be responsible for technological assistance, application instruction and servicing of the entire line of ZPT's conventional and multi-color coatings. In addition, his duties will include liaison activities with military services as well as assisting aircraft and marine industries in development of specialized coatings.

Prior to joining the firm, Lee served as materials and process engineer for Douglas Aircraft Co., El Segundo,

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Calif., where he was engaged in research and development of protective coatings used on radioactive materials. He also formerly operated his own industrial display and merchandising firm, known as Morton A. Lee and Associates, for a five year period.

He is a fourth generation of a family of paint men and has more than 25 years experience in all phases of paint manufacturing, processing and application. His background encompasses fundamental knowledge in lacquers, oleoresins, PVA's and plastic base coatings and such processes as electrostatics, metal graining and dipping.

Ransburg In New Quarters

Ransburg Electro-Coating Corp. have moved into their new building located northwest of the Indianapolis city limits, at 3939 West 56th St. The new building is part of a million and a half dollar expansion and building program.

More than 18,000 square feet of the new 80,000 square foot plant are devoted to engineering and laboratory



testing facilities. Sixteen conveyORIZED demonstration laboratories are available for test-painting small articles, as well as bigger products the size of an automobile body.

Lab facilities include various overhead conveyors, some with pit-mounted or ceiling-mounted reciprocating disk units; a spindle-type conveyor with a stationary No. 2 Process disk unit; a double loop conveyor with two disk units; one overhead conveyor line which is used for demonstrating triple head No. 2 Process equipment; one large booth to demonstrate the No. 2 Process on big articles, such as automobile bodies, which are conveyORIZED through the electro-spray area on a

dolly. Another lab is maintained for No. 1 Process applications. Nearby are three batch bake ovens for baking out the parts after painting. Four laboratory and engineering conference rooms are located just off the lab area.

Other technical facilities include the automatic equipment manufacturing area; a machine and welding shop, and a conference room set up with movie projection equipment. The "back" part of the plant includes paint mixing and stripping rooms. There is ample storage space for articles and products sent into the plant for lab demonstrations. A fireproof paint storage building is located at the rear, away from the main building.

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more economically . . .
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Ten different basic CLAIR models to choose from.

Write for information on any surface finishing problem you may have.

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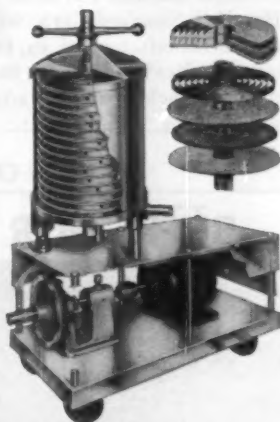
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due to pitting or
rough deposits !

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The Alsop Method of "SUB-MICRON" filtration assures you of totally clean plating solutions at all times with no interruption in your plating cycle! All impurities are automatically removed as fast as they are formed or introduced.



FREE! Your guide to better plating. "The Use of Filters in Electroplating" by J. B. Mohler

ENGINEERING CORPORATION
1310 Bright St., Milldale, Connecticut

Conveyorized Finishing System Division Formed by M-H Standard

Sparked by the ever-growing demand of finishing departments for better quality, lower costs and faster production in this important category, this division will specialize in the design and construction of the latest finishing techniques and equipment, with special emphasis on coating machinery, drying and baking ovens, and the most modern methods of conveyorization.

H. H. Morrison has been appointed as the technical director of this new division. Mr. Morrison is an engineer specializing in the field of industrial finishing, having developed and pioneered successful techniques particularly in the finishing of furniture and steel, wood and Masonite cabinetry.

A conveyorized finishing laboratory, including a production Morrison grainer has been set up in the company's Jersey City plant. This will permit full scale application of wood grain, marbelized and other finishes to Masonite, wood and metal panels, cabinets and parts furnished by customers in their study to reduce the cost of finishing furniture, TV cabinets, appliances, paneling and other items which can now be given a better grain finish than the actual wood at a much lower material and labor cost.

The M-H Standard Corp. will continue the manufacture of its full line of standardized material handling equipment, much of which is adaptable to the finishing field.

Manufacturers' Literature

Anodizing Aluminum Automatically

*Frederic B. Stevens, Inc., Dept. MF,
1800 18th St., Detroit 16, Mich.*

An authoritative study of the use of automatic equipment in anodizing aluminum contains a detailed analysis of anodizing conditions, film qualities, racking, handling current surges, tank design, temperature control, cleaning, bright dipping, coloring and sealing.

Conversion Coatings

MacDermid Inc., Dept. MF, Waterbury, Conn.

Maccromates, a new group of compounds for producing chromate conversion coating on zinc and cadmium plated work, on zinc diecastings, and on aluminum is fully described in 4-page Technical Data Sheet No. 76.

Phosphotex, an iron-zinc phosphate process for rust proofing steel, zinc, base diecastings, zinc and cadmium plate is covered in 4-page Technical Data Sheet No. 27.

Current Rating Chart for Selenium Rectifiers

Syntron Co., Dept. MF, 732 Lexington Ave., Homer City, Penna.

A four-page booklet gives complete

listing of continuous d-c ampere current ratings for 26, 33, 36, 40, 45 and 52 volt RMS "vacuum process" selenium rectifier cells. It also gives size specifications and other pertinent data for a complete range of 20 cell sizes from one inch square to twelve by sixteen inches.

Chromate Coatings

Conversion Chemical Corp., Dept. MF, 98 E. Main St., Rockville, Conn.

Newly available is fact sheet #F-Z, an aid to quick selection of the proper chromate sealing and brightening finishes for nonferrous metals.

Printed on the front and back of a single sheet are the specifications for use on the right Kenvert coating for each metal and each type of finish desired. It is a handy reference and aid to all in the industry.

Organic Finishes

Industrial Finishes Co., Inc., Dept. MF, 1119 Land Title Bldg., Broad & Chestnut Sts., Philadelphia 10, Penna.

The above manufacturer has prepared a series of case histories on how most metals can be coated with Ifco Catalytic coating without pre-treatment.

Magnetic Flow Meters

The Foxboro Co., Dept. MF, Foxboro, Mass.

Described in new Bulletin 20-14C are two new magnetic flow meters developed for 1/10 and 1/8-inch flow lines, which permit measurement of full scale flow rates as low as 0.1 gallon per minute.

In addition to a description of meter features, the two-page bulletin outlines typical "difficult" liquids which can be measured and stresses the use of the instruments in ratio flow control and pilot plant applications.

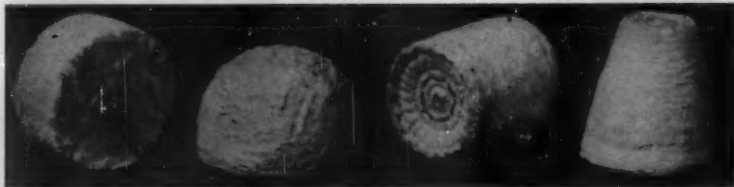
Also included are full specifications, dimensions, and other instrument data.

Metal Degreasing

L. Sonneborn Sons, Inc., Dept. MF, 600 Fourth Ave., New York, N. Y.

The more modern methods of degreasing metal surfaces are examined in one of a series of new bulletins. Emulsion cleaners are broken down into three types: stable emulsion type cleaners, two-phase, or diphase, emulsion type cleaners and soak-type emulsifiable cleaners. The bulletin then discusses the principles on which each

BUFFS FOR INSIDE POLISHING



GOBLET BUFFS, TAPER BUFFS, CYLINDER BUFFS, SMALL POLISHING WHEELS, RAZOR EDGE BUFFS, and many others for deburring, polishing and grinding any internal contour.

Write for additional information or contact your local dealer. These buffs are stocked by many dealers throughout the country.

We manufacture a COMPLETE LINE OF BUFFS including full disc loose and sewed buffs and polishing wheels. Our metal center BIAS TYPE BUFF may help cut your polishing costs.

Your request on your letterhead will bring our complete catalog by return mail.

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type is based and how they should be used.

Air Moving Equipment

Wm. W. Meyer & Sons, Inc., Dept. MF, 8311 Niles Center Road, Skokie, Ill.

A handy reference guide, for those interested and responsible for operation and installation of blowers, fans, exhausters and other air moving equipment, consists of an attractive letter-size file folder, engineering data sheets and stock lists of all types of rebuilt and new air moving equipment.

Rectifiers

Rapid Electric Co., Dept. MF, 2881 Middletown Rd., New York 61, N. Y.

Bulletin GSR-1 gives information on germanium and silicon rectifiers, stressing the improved design of the latest diodes used in all their units for efficiency, stabilization and balancing. Facts are also given on rectifier controls, circuit protection, and features.

Phosphating Process

Rusticide Products Co., Dept. MF, 3125 Perkins Ave., Cleveland 14, Ohio.

Four-page folder describes how Ospho, when applied directly to rusted metal, chemically changes rust to iron phosphate, thus preparing the surface for regular maintenance paint. It also tells how the product provides a good bond between new metal and paint.

Airless Spray

Bede International Development Co., Dept. MF, 14237 Detroit Ave., Cleveland 7, Ohio.

Informative 4-page brochure illustrates and explains the airless spray process as it is used throughout the world. Literature tells how the process reduces painting costs up to 50% and permits better, faster, more economical painting.

Wet Blast Applications

Techline Div., Wheelabrator Corp., Dept. MF, 1179 Avenue V, Vicksburg, Mich.

Precision finishing by the wet blasting method is the subject of Bulletin 100, which illustrates and describes efficient applications of Liquamette Model 43 wet blast equipment.

Polyethylene Tanks

American Agile Corp., Dept. MF, 5461 Dunham Road, Cleveland, Ohio.

A new catalog sheet, illustrates and describes a line of standard tanks in branch and linear polyethylene and polypropylene.

The tanks illustrated include a cylindrical, self-supporting unit; a square, self-supporting tank; and a rectangular, self-supporting tank. Complete specifications, design features and application information are included for

each type tank. In addition, the catalog sheet pictures and details specially designed polyethylene tanks and liners.

Filters

Commercial Filters Corp., Dept. MF, Melrose, Mass.

Fulflo filters for electroplating, water and compressed air are illustrated and described in Bulletin GEO-508. A new stainless steel filter is also highlighted.

Heaters and Devices

General Electric Co., Dept. MF, Schenectady 5, N. Y.

A new heaters and devices catalog supplies answers for hundreds of heating problems and helps expedite product delivery by clarifying ordering information. The 52-page booklet is designated GEC-10051.

New product information is included on pipe heaters, thermostatically controlled immersion heaters, 1-inch diameter water immersion heaters, domestic water heater replacement elements, new ratings and configurations of tubular heaters and many others.

Various heating processes are described in a 10-page power requirements section. Typical application problems are solved to give heating requirements in a short-form method. The short-form calculations give adequate accuracy for ordinary requirements.

The streamlined publication includes

EPC - 300

(McGoy's Copper)

SINGLE ADDITION BRIGHTENER

THE MOST TALKED ABOUT PROCESS IN THE MIDWEST

It produces deposits which are bright from deep recesses to very high densities.

When used under recommended conditions with Electrosolv, (Electrosolv is a superior addition agent for the improvement of anode corrosion) it is capable of depositing copper at the rate of a mil. in 10 minutes.

Operating range is wide:
Temperatures from 140-180°F.
Wide range of solution composition.

Air Agitation with 300-W.
Non-foaming wetting agent.
No electrocleaning required for direct plating with nickel.

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up-to-date data, specifications, operating information and manufacturer's recommended list prices of standard heaters and heating devices. Included are immersion, strip, cartridge, tubular, finned tubular and railroad switch heaters. Unit heaters, soldering irons, soft metal melting pots, oven equipment and controls are also described.

Dry and Water-wash Exhaust Booths

Eclipse Air Brush Co., Dept. MF, 390 Park Ave., Newark 7, N. J.

A four-page folder covering dry and water-wash exhaust booths includes fan data, diagrams, and other pertinent information.

Current Interrupter

Rapid Electric Co., Dept. MF, 2881 Middletown Rd., New York 61, N. Y.

Bulletin CL-1 illustrates and describes the above firm's current interrupter, listing its features, electroplating applications, and advantages.

Associations and Societies

AMERICAN ELECTROPLATERS' SOCIETY

Miami Branch

The August 22nd meeting was held at Jerry's Restaurant. After dinner, Pres. Dent showed slides taken of his trip through South America. Included were many good shots of the new plating shop his company (Pan American Airways) is building in Brazil.

Discussion ensued concerning the 1959 technical session of the Dixie region, which will be held in Miami.

Fred Fulforth of Metal and Thermit was present at the meeting and disclosed to the members that he had just purchased a home in this area.

Robert F. Wharton
Librarian

Fifth International Conference on Electrodeposition and Metal Finishing

Walter L. Pinner, chairman Educational Committee reports that commitments for technical papers to date have been received from thirty-eight authorities in the metal finishing industry. These experts will discuss a variety of subjects including new plating developments, corrosion and accelerated corrosion testing, physical properties of plated coatings, finishing processes for aluminum and the electropolishing of metals. Ten educational sessions are planned for the five-day conference. Two of these will be devoted to organic finishing and the application of plastic coatings to electroplating equipment and fixtures.

The speakers who will present these subjects truly represent the metal finishing industry on an international scope. The present list includes eminent personalities from England, France, Germany, Switzerland, India, Canada and the United States. Key-noting the conference will be the first *William Blum Lecture* which will occur at the opening educational session. Appropriately, Dr. Blum, who has been referred to as the dean of American electroplating practice, will deliver the lecture. This honor results from the action of the American Electroplaters

Society which recently declared him the first winner of the A.E.S. Scientific Achievement Award.

Some of the conference sessions will be held at the Statler Hotel in Detroit. Other sessions will be held at the site of the impressive Metal Finishing Exposition, an important part of the overall program. Adequate transportation for conference guests will be furnished to the site of the Exposition.

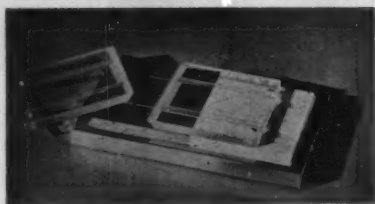
ZINC AND LEAD INDUSTRIES CHOOSE RESEARCH DIRECTOR



Dr. Schrader F. Radtke

A director has just been appointed to head the joint research program currently being initiated by the American Zinc Institute and the Lead Industries Association. He is *Dr. Schrader F. Radtke*, until now director of the metallurgical research laboratories of Reynolds Metals Co. at Richmond, Virginia, a lecturer on the staff of the Research and Development Division of the American Management Associa-

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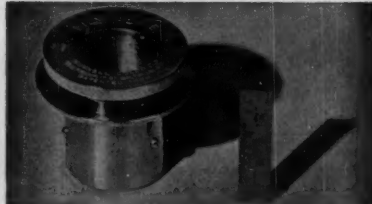
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tion and president of the Richmond, Va., chapter of the American Society for Metals.

Born in Minneapolis, Dr. Radtke received his doctorate in chemistry from M. I. T. in 1949, his Bachelor of Science Degree in 1940. After completing graduate work he joined DuPont where he became research supervisor. He joined Reynolds Metals Co. in 1953. During World War II he was Chief of the Production Division, N. Y. Procurement Office of the Transportation Corps.

He holds a professional engineer's license for Illinois and Delaware, and is a civilian consultant for Frankford Arsenal, Ordnance Corp., United States Army.

THE SOCIETY OF THE PLASTICS INDUSTRY, INC.

The annual National Conference of The Society of the Plastics Industry and the eighth National Plastics Exposition will be held November 17-21, 1958 at the Chicago International Amphitheater, Chicago, Ill.

"Plastics for Profits" is the theme of the show, which will feature over 250 displays of plastic products. Admission will be by ticket only, and tickets may be obtained by writing on business or company letterhead to the Society at 250 Park Ave., New York 17, N. Y.

N.A.C.E.

Approximately 24 technical papers will be presented in four symposia during the technical program at the New Orleans meeting of National Association of Corrosion Engineers, October 20-24, 1958. It will be the twelfth annual meeting of the South Central Region.

In addition to hearing technical pa-

pers in symposia, corrosion engineers will discuss their problems in more than 20 technical committee meetings. Most committees are composed of engineers from the petroleum and petrochemical industries in this part of the nation. However, preventive methods which are of a general nature, protective coatings and cathodic protection, also will be discussed.

About 24 companies have already contracted for booth space in the exhibition to be held in connection with the conference.

While emphasis is on the technical side and the exhibition, conference officials also have planned social activities for both gentlemen and ladies. Heading the list of prominent guests will be L. L. Whiteneck, Plicoflex, Inc., Los Angeles, president of NACE and Hugh P. Godard, Aluminium Laboratories, Ltd., Kingston, Ontario, vice president.

SOCIETY OF VACUUM COATERS

The society will hold a Fall Meeting and Technical Conference at the Hotel Statler, Detroit 31, Mich., November 5th and 6th.

The technical program of interest to those who employ high vacuum deposition for functional and decorative coating is as follows

... PROGRAM ...

Wednesday, November 5, 1958

1:00 P.M. Registration Desk Open.

2:00 P.M. Open Business Meeting.

Thursday, November 6, 1958

9:15 A.M. Opening Address

T. J. LaBounty, President, S.V.C.

9:30 A.M. Maintenance Problems in Vacuum Coating Systems

J. P. MacNeil

National Research Corp.

10:15 A.M. Selection of Oven Equipment for Vacuum Coaters

Herman C. Gehrlich
Gehrlich & Gehrlich, Inc.

11:00 A.M. Coffee Break

11:15 A.M. Glow Discharge Cleaning
John Smith

Consolidated Electro-dynamics Corporation
Rochester Division

12:00 Noon An Analytical Method of Leak Determination in High Vacuum Systems

A. Schlafmitz
Vacuum Metallizing Corporation

12:30 P.M. Recess

1:00 P.M. Luncheon

2:00 P.M. Reconvene

2:05 P.M. Presentation by Conforming Matrix

Functional Coatings — Techniques of Reproductions, Monitoring, and Evaporation

Dave Baum
Vacuum Equipment Division, The New York Air Brake Company

3:15 P.M. Coffee Break

3:30 P.M. Dip Dying of Finishes for Vacuum Metallizing

B. Perkel
Jema-American

4:00 P.M. Presentation by F. J. Stokes Corporation

4:30 P.M. New Coating Developments for Vacuum Metallizing

J. Scharnberg
Logo

5:15 P.M. Adjournment

C. G. Northrup,

C. G. Northrup, Vice President
Society of Vacuum Coaters

INDUSTRY ... large and small ... relies on RANDOLPH for highly suitable finishes

Lacquers • Synthetic Enamels • Air-Dry Lacquers
Baking Enamels • Wood Lacquers • Texture Enamels
Aircraft Dopes • Aircraft Enamels
Specialized Production Finishes for exacting requirements in
QUALITY • UNIFORMITY • PROTECTION
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RANDOLPH PRODUCTS COMPANY
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FROIL Rust Preventive OIL

Positive barrier against corrosion that lasts for MONTHS.

Protects any metal—even delicate MICRO-finishes.

Eliminates fingerprint damage and water spotting.

Water displacing agent—lifts moisture from deepest crevices.

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OCTAGON

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NEW BOOK

Coated Abrasives — Modern Tool of Industry

Published by McGraw-Hill Co., 330 West 42nd St., New York 36, N. Y. 1958. 426 pages, including index. Price: \$8.50.

Here is a book which could serve as a model for treatment of a subject involving trial and error methods rather than a specific approach. The anonymous editors of this volume, prepared under the auspices of the Coated Abrasives Manufacturers' Institute, have made use of 546 illustrations, more than one per page, a good many of which show applications of coated abrasives on a multitude of articles and employing every possible type of equipment.

Any finisher concerned with polishing will find the material by far the most valuable addition to his technical library, and he can also take it home once in a while, because the authors have not forgotten to include a section on helpful pointers for the home craftsman. Starting with the manufacture of these abrasives and a description of the numerous types available, the book goes on to illustrate applications in various industries for operations from rough grinding to fine polishing on metals and non-metals.

Belts, contact wheels and idlers are covered in complete detail, as are polishing costs, lubricants, and specific methods. Even the chapters on polishing glass and wood are valuable, as guides and hints can often be adapted to metals and plastics. It would seem that every conceivable use of sheets, discs, belts, and cylinders of coated

abrasives is described with the view of assisting finishers to achieve most efficient results. We doubt whether any purchaser will be disappointed in the contents.

News from California

By Fred A. Herr



Dr. Leland G. Cole has been named chief research chemist, and Dr. Charles F. Robinson as chief research physicist, at Consolidated Electrodynamics Corp., Pasadena, Calif.

Dr. Cole has been with the firm as senior chemist since 1955. He previously served as director of the dynamics laboratory for Robertshaw-Fulton Co., and as senior research engineer at the California Institute of Technology, Jet Propulsion Laboratory, in Pasadena.

Dr. Robinson has been on the staff of Consolidated Electrodynamics since 1947.

R. M. Norton, vice president in charge of sales for Hanson-Van Winkle-Munning Co. of Matawan, N. J., was in California on a business trip in mid-August. He conferred in Los Angeles with Alford Perkins, president, and A. D. Gaskin, general manager of Alert Supply Co., H-VW-M's west coast subsidiary; and in San Francisco with James Hodges and Harold Smallman of Alert's Bay area staff.

Dedication ceremonies were held recently at Paramount, Calif., to mark

the official opening by the American Brass Co. of the west coast's newest brass mill. The company's new copper and copper alloy manufacturing facilities on the southeastern outskirts of Los Angeles represent an investment of \$18 million in buildings and equipment. The new Paramount plant is the firm's 12th in the United States.

Present for the dedication were John A. Coe, Waterbury, Conn., board chairman; Charles C. Stone, president; James F. Ackerman, vice-president; C. Russell Epley, vice-president in charge of the Paramount factory; and western sales manager H. Allison Buckbee.

American Potash & Chemical Corp. reports the completion of a new three story building at Sixth St. and Virgil Ave., Los Angeles, which will henceforth serve as the firm's world headquarters.

Nine hundred metal finishers and fabricators attended a recent two-day All-Abrasive Show held in Seattle, Wash., at which new concepts in grinding and polishing and new abrasives and abrasive products were featured.

Held in the Seattle plant of Campbell Industrial Supply Co., the show was sponsored by the company in cooperation with the Behr-Manning Co., Weldon Co., Black & Decker Co., and a number of Seattle firms. Demonstrations were presented by a number of firms. On demonstration were surface grinders, carbide grinders, cutter grinders and a variety of portable tools used in grinding and polishing operations. Coated abrasives were exhibited and visitors were shown films covering grinding, polishing, wheel safety, and the proper way to use various grinding and polishing tools.

A permit was issued in August for

SOMMERS BROS. MFG. CO.

MFRS. OF "BEACON"

Plating and Polishing Supplies and Equipment —Complete Semi and Full Automatic Installations—Gold, Silver and Chrome Rouge, Stainless Steel and Satin Finish Compounds—Buffs, Polishing and Felt Wheels.

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ST. LOUIS 7, MO.

\$25 A WEEK RAISE!

"I have practically taken over all the plating in our plating and research lab after having completed a little over half of your lessons. The best part though is a \$25 a week raise even during the present recession, writes plater Ed Osborne of Evanston, Illinois. Like hundreds of others he has found out that ELECTROPLATING KNOW HOW training doesn't cost — it PAYS. Investigate Dr. Joseph B. Kushner, Electroplating School, 2509 Washington Ave., Evansville 14, Ind.

HAMILTON MILLS



For color and lustre beyond compare, specify INDIAN BRAND TURKISH EMERY. Preferred by those who know the best.

Also available — HECCO BRAND AMERICAN EMERY, for use in abrasive pastes and compositions.

HAMILTON EMERY & CORUNDUM CO.
CHESTER, MASS.

construction in Monrovia, Calif., of a new factory building for the Chem-Therm Corp., to replace the one destroyed by fire earlier this year. Cost of the new one-story building was announced as \$87,000. It will be designed for the future addition of a mezzanine floor.

United States Steel Corp. has started installation of a third new high-speed electrolytic tinning line at its Pittsburgh, Calif., plant. The new line is designed to produce in one minute enough tin plate to make 6,000 average size tin cans. The line is 350 feet long and has 60 feet of construction below ground level. Its height is equal to that of an eight story building. Steel passes through the electrolytic line at speeds up to 1250 feet per minute. The new line employs the latest product and quality control devices, including nuclear radiation and photoelectric detection. It also includes a built-in data collecting system to provide continuous recording of thickness of the steel and the tin coating. The new line will supply tin plate for shipment both in coiled form and cut length. The electrolytic tinning process is reported to provide more uniform quality of tin plate than the older hot-dip tinning method and uses less than one-half as much tin.

"Tooling for the Space Age" was the theme of the 1958 Western Tool Show held at Shrine Exposition Hall, Los Angeles, under the sponsorship of the American Society of Tool Engineers, September 29 to October 3.

Five full days of technical symposia and seminars were on the program. The exhibits were housed in 250 booths. The show was designed to pro-

vide an opportunity to pool existing knowledge of new developments in equipment, processes and methods to meet the challenge of the space age.

Technical subjects discussed by some 40 speakers included "Metal Forming," "Plastics in Tooling Applications," "Tooling Space Airframes," "Tool Engineering for Numerical Construction," "Tooling for Electronics" and "Quality Control Methods."

OBITUARIES

WILLIS M. FOTHERINGHAM



Willis M. (Bill) Fotheringham, president of W. M. Fotheringham, Inc., died recently at the age of 60 after a heart attack aboard his sailboat.

Mr. Fotheringham founded his firm several years ago, after a career as an electroplating equipment salesman. He

was a member of the *American Electroplaters' Society*, active in the Buffalo branch, where he was a former vice-president, librarian, and a member of the Board of Managers. He was also a member of the *American Society for Metals*, *The American Chemical Society*, *The Faraday Society*, and Britain's "Institute of Metal Finishing."

He is survived by four brothers, Robert L. of Lakewood, O., John of Toledo, O., Joseph H. of Vista, Calif., and Alexander of Shaker Heights, O.; also a nephew, Charles R. Fotheringham.

HENRY L. ZUCKER

Henry L. Zucker, 87, vice president of *Hanson-Van Winkle-Munning Co.*, died Thursday, Sept. 4, at his home, 14 Schanck Ave., Matawan, N. J.

Mr. Zucker was born in New York City the son of the late George W. and Ann Mary Butz Zucker. He was a pioneer in the development and manufacture of buffing compounds, having succeeded his late father as president of the George Zucker Co., which was merged in 1918 with the Munning-Loeb Co. of Matawan, to become A. P. Munning & Co.

Mr. Zucker was a member and former trustee of the First Presbyterian Church; a former member of the Borough Council; past president of the Board of Education; and one of the organizers and former president of the Liberal Building and Loan Association.

Surviving are his wife, Mrs. Louise Brown Zucker; two daughters, Mrs. Alice Harding and Mrs. Mildred Beam Kane; two sons, Henry G. Zucker and Harold F. Beam; seven grandchildren; a sister, Mrs. Arthur Gude, Caldwell, N. J.

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- 1—500 AMPERE, 25 VOLT. CHANDEYSSON, Synchronous, Exciter-in-head.
- 4—400 AMPERE, 40 VOLT. M.G.C., Separately Excited.

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- 1—G. E. 2000/1000 AMP., 6/12 V.
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- 2—CROWN & H-VW-M Centrifugal Dryers No. 1 and No. 2 with Heat.
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- Rapid 300 amps. 6 volts with control.
- G. E. 2000 amps. 6 volts with control.

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- 1—H-VW-M 32' x 5 x 4 steel.
- 1—H-VW-M 25' x 5 x 4 rubber lined.

PLATING BARRELS

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- 1—Lasalco steel 36 x 18 Lucite cylinder.
- 1—Lasalco rubber lined 30 x 15.
- 1—H-VW-M steel 36 x 18.
- 2—Udylite multi-purpose barrel — hard rubber cylinder.
- 1—Belke oblique plater.

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Industrial, Alsop, Sethco — all sizes — nickel and cyanide solutions.

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- 4—Henderson barrels.
- 4—Globe barrels.
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- 4—#101 Tandum 15 H.P.
- 1—Production Machine #101 — 7½ H.P.
- 2—Production Machine #484-2.
- 2—L'Homedieu 5 H.P. variable speed.
- 10—Holland 5 H.P.
- 1—Acme L-82.
- Gardener 5 H.P. — 7½ H.P.
- Holland 7½ H.P.
- Divine Idlers.

DRYERS

- 2—Barrett centrifugal dryers.
- 1—H-VW-M centrifugal dryer.
- 2—Kreider with steam explosion proof motor — 12 x 12.

BOILERS

Kane gas fired 20 H.P., 7½ H.P.

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300—Assorted buffing and polishing machines from 1 HP to 50 HP single and double end spindles, including some variable speed types.

50—Assorted Plating Barrel Units, Standard Makes for all solutions.

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25—Assorted full automatic rotary Buffing, Polishing, & Deburring Machines, Divine, Hammond, Packer, Acme, etc. tables from 20" to 72" diameter, with 3, 4, 5 and 6 heads.

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2—Terit 3 H.P. Units (2 Lathes).
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Switches Available in All Combinations & Sizes.

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1—18" x 36" I.D.
1—18" x 36" I.D.
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2—Henderson 2 Barrels in Frame.
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GUARANTEED REBUILT PLATING RECTIFIERS — 3 PHASE, 60 CYCLE, 220/440 VOLT. COMPLETE WITH OPERATING ACCESSORIES.

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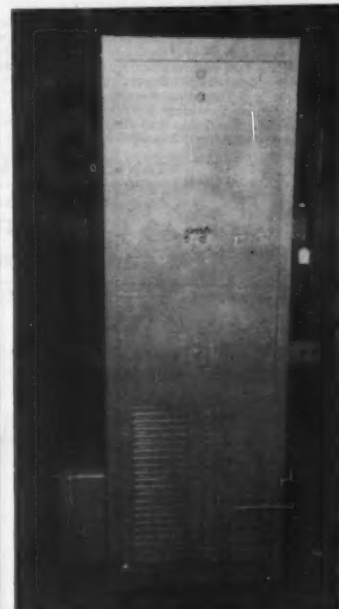
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- 1—Rapid 100 amperes @ 12 volts.
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- 1—Selenium 150 amperes @ 12 d.c. volts.
- 1—Rapid 200 amperes @ 6 d.c. volts.
- 1—Hobart 200 amperes @ 12 d.c. volts.
- 1—G.E. 300 amperes @ 6 d.c. volts.
- 5—Selenium 500 amperes @ 6 d.c. volts.

- 10—Udylite 750 amperes @ 12 d.c. volts.
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- 1—H.V.W.M. 1250 amperes @ 12 d.c. volts.
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200	7½	Chandeysson
200	65	G. E.
100	80/90	Reliance
200	7½	Hobart
300	7½	Hobart
400	80/80	G. E.
400	6	H-V-W
940	32	Elec. Prod.
1000/300	6/12	Chandeysson
1500/750	6/12	H-V-W
1500	15	Star
1500	30/50	Century
1500	40/65	G. E.
1500	65	Westinghouse
1500	70	Century
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5000/2500	6/12	Columbia
5000/2500	9/18	Chandeysson
7500	9	Elec. Prod.

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5,000 Amp.	50 mv.
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Amp. 40 VOLTS, 3 phase, 60 cycle,
220/440 volts, 600 RPM SYN-
CHRONOUS MOTOR, WITH
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SUPPLIERS OF EQUIPMENT AND MATERIALS AND ADVERTISERS INDEX

Abbey Process Automation, Inc. 37-01 48th Ave., Long Island City 1, N. Y.	24	Federated Metals Div., American Smelting & Refining Co. 120 Broadway, New York 5, N. Y.	9	Northwest Chemical Co. 9310 Roselawn Ave., Detroit 4, Mich.	15
Abrasive Products, Inc. So. Braintree 85, Mass.	97	Formax Mfg. Corp. 3171 Bellevue, Detroit 7, Mich.	111	Norton Co. 1 New Bond St., Worcester 6, Mass.	44A
Acme Manufacturing Co. 1400 E. 9 Mile Rd., Detroit 20 (Ferndale), Mich.	26	G. S. Equipment Co. 15585 Brookpark Rd., Cleveland 10, Ohio	20	Oakite Products, Inc. 18 Rector St., New York 6, N. Y.	4
Agate Lacquer Mfg. Co. 11-13 43rd Rd., Long Island City 1, N. Y.	109	Glo-Quartz Electric Heater Co., Inc. Willoughby, Ohio		Otagon Process Inc. 15 Bank St., Staten Island, N. Y.	117
Allied Supply Co. 2041 S. Davis Ave., Los Angeles, Calif.		Graver Water Conditioning Co. 216 W. 14th St., New York 11, N. Y.	16	Packer Machine Co. 456 Center St., Meriden, Conn.	
Allied Research Products, Inc. 4004 E. Monument St., Baltimore 5, Md.	88	Gumm Chemical Co., Inc., Frederick 538-542 Forest St., Kearny, N. J.		Park Chemical Co. 8074 Military Ave., Detroit 4, Mich.	
Ashop Engineering Corp. 1310 Bright St., Milldale, Conn.	113	Hamilton Emery & Corundum Co. Chester, Mass.		Pennsalt Chemicals Corp. 3 Penn Center Plaza, Philadelphia 2, Pa.	
Alvey-Ferguson Co. 502 Disney St., Cincinnati 9, Ohio	107	Hammond Machinery Builders, Inc. 1601 Douglas Ave., Kalamazoo 54, Mich.		Pesco Plating Equipment Corp. 75 Wythe Ave., Brooklyn 11, N. Y.	121
American Brass Co. Waterbury 20, Conn.		Hammond Solvents Recovery Service 241 Brunswick St., Hammond, Ind.	95	Pfizer & Co., Inc., Chas. 630 Flushing Ave., Brooklyn 6, N. Y.	19
American Buff Co. 2414 S. LaSalle St., Chicago 16, Ill.	6	Handicraft Tools, Inc. 48-81 Van Dam St., New York, N. Y.		Phelps Dodge Refining Corp. 300 Park Ave., New York 22, N. Y.	98
American Platinum & Silver Div., Engelhard Industries, Inc. 231 New Jersey R. R. Ave., Newark 5, N. J.		Handy & Harmon 82 Fulton St., New York 38, N. Y.		Plating Products, Inc. 1509 N. Washington, Kokomo, Ind.	106
Ampco Metal, Inc. 1945 So. 38th St., Milwaukee 46, Wis.		Hanson-Van Winkle-Manning Co. Matawan, N. J.		Potter Paint Co., Inc. 21 Crawford St., Cortland, N. Y.	30
Apothecaries Hall Co. 22 Benedict St., Waterbury 20, Conn.		Harrison & Co., Inc. 487 Groveland St., Haverhill, Mass.		Promet Div., Peor & Co. 851 S. Market St., Waukegan, Ill.	34
Armitage & Co., John L. 245 Thomas St., Newark 5, N. J.	92	Harshaw Chemical Co., The 1945 E. 97th St., Cleveland 6, Ohio	35	Quartz Radiation Corp. 54 Summer Ave., Newark, N. J.	
Atlas Mineral Products Co. Mertztown, Pa.		Heathbath Corp. Springfield 1, Mass.	30	Ramco Equipment Corp. 807 Edgewater Rd., New York 59, N. Y.	
Beacon Felt Co. 437 W. Water St., Taunton, Mass.	28	Heil Process Equipment Corp. 12901 Elmwood Ave., Cleveland 11, Ohio		Randolph Products Co. 92 N. 12th St., Carlstadt, N. J.	117
Baird Machine Co. Stratford 9, Conn.		Henderson Bros. Co. 136 S. Leonard St., Waterbury, Conn.	96	Rapid Electric Co. 92 N. 12th St., Carlstadt, N. J.	7
Baker Bros., Inc. 564 E. First St., So. Boston 27, Mass.	121	Holland & Sons, Inc., J. 485 Keap St., Brooklyn 11, N. Y.		Raybestos-Manhattan, Inc. Manhattan Rubber Div. Passaic, N. J.	
Baker Co., Alan 180 Sylvester Rd., South San Francisco, Calif.	122	Hooker Chemical Corp. 1303 Union St., Niagara Falls, N. Y.	120	Reynolds Chemical Products Co. 1200 N. Main St., Ann Arbor, Mich.	
Baker Co., The M. E. 25 Wheeler St., Cambridge 38, Mass.	120	Hull & Co., Inc., E. O. 1300 Parsons Ct., Rocky River 16, Ohio		Robertshaw Fulton Controls Co., Fulton Siphon Div. Knoxville 1, Tenn.	89
Barker Bros., Inc. 1660 Summerfield St., Brooklyn 27, N. Y.	114	Ideal Chemical Co. 1499 Dean Dr., So. Euclid 21, Ohio	122	Rona Laboratories, Inc. E. 21st & E. 22nd Sts., Bayonne 3, N. J.	119
Beam-Knodel Co. 195 Lafayette St., New York 12, N. Y.	112	Illinois Water Treatment Co. 840 Cedar St., Rockford, Ill.	103	Sandoz, Inc. 61 Van Dam St., New York 13, N. Y.	
Beck Equipment Co. 3352 W. 137th St., Cleveland 11, Ohio	110	Industrial Filter & Pump Mfg. Co. 5906 Ogden Ave., Chicago 50, Ill.	18	Saran Lined Pipe Co. 2415 Burdette Ave., Ferndale 20, Mich.	14
Belke Manufacturing Co. 947 N. Cicero Ave., Chicago 51, Ill.	97	Industrial Instruments, Inc. 89 Commerce Rd., Cedar Grove, N. J.		Schorl Process Div., Ferro Co. Corp. 8-11 43rd Rd., Long Island City, N. Y.	
Better Finisher & Coatings, Inc. 268 Doremus Ave., Newark 5, N. J.	23	International Rectifier Corp. 1521 E. Grand Ave., El Segundo, Calif.	40, 41	Sel-Rex Corp. 75 River Rd., Nutley 10, N. J.	
Blakeslee & Co., G. S. 1844 S. Laramie Ave., Chicago 50, Ill.		Ionic Electrostatic Corp. 105-119 Monroe St., Garfield, N. J.	44	Service Screw Products Co. 131 N. Green St., Chicago 7, Ill.	
Brucar Equipment & Supply Co. 602-604 20th St., Brooklyn, N. Y.	122	Jelco Finishing Equipment Corp. 153 E. 26th St., New York 10, N. Y.		Sethco Mfg. Co. 2286 Babylon Turnpike, Merrick, L. I., N. Y.	29
Chanderson Electric Co. 4074 Bingham Ave., St. Louis 16, Mo.	17	Kascar Company 4802 S. St. Louis Ave., Chicago 32, Ill.	34	Siefen Co., J. J. 5643 Lauderdale, Detroit 9, Mich.	108
Chemical Corp., The 58 Waltham Ave., Springfield, Mass.	105	Kocher Instrument Co., Inc. 168-56 Douglas Ave., Jamaica 33, N. Y.	116	Solborn Mfg. Corp. 120 13th St., Brooklyn 15, N. Y.	
Churchill Co., Inc., Geo. R. Hingham, Mass.	29	Kosmos Electro-Finishing Research, Inc. 140 Liberty St., Hackensack, N. J.		Solvay Process Div., Allied Chemical Corp. 61 Broadway, New York 6, N. Y.	33
Ciba Co., Inc. 627 Greenwich St., New York 14, N. Y.		Kushner, Dr. Joseph B. 2509 Washington Ave., Evansville, Ind.	118	Solvents Recovery Service 1025 Broad St., Newark 2, N. J.	115
Cincinnati Cleaning & Finishing Machinery Co. 2027 Hogeman St., Cincinnati 41, Ohio	100	Lesco, Inc. 2820-38 LaSalle St., St. Louis 4, Mo.	21	Sommers Bros. Mfg. Co. 3439 No. Broadway, St. Louis 7, Mo.	118
Cinco Equipment Co. 51 Terminal Ave., Clark Twp. (Rahway), N. J.	99	Lee Mfg. Co. 16 Cherry Ave., Waterbury 20, Conn.	92A	Spee Flo Mfg. Corp. 6614 Harrisburg, Houston 11, Texas	
Clair Manufacturing Co., Inc. Olean, N. Y.	113	Lee Michigan, Inc. 14066 Stansbury Ave., Detroit 27, Mich.		Stevens, Inc., Frederic B. 1808 - 18th St., Detroit 16, Mich.	8
Cleveland Process Co. 1965 E. 57th St., Cleveland 3, Ohio	87	Lee-Ronal, Inc. 139-20 109th Ave., Jamaica 35, N. Y.	92B	Stokes Corp., F. J. 5500 Tabor Rd., Philadelphia 20, Pa.	
Clinton Supply Co. 112 S. Clinton St., Chicago 6, Ill.	121	Lewis Welding & Engineering Corp. 106 Northfield Rd., Bedford, Ohio		Storts Welding Co., Inc. 38 Stone St., Meriden, Conn.	108
Cohn Mfg. Co., Inc., Sigmund 121 S. Columbus Ave., Mt. Vernon, N. Y.	28	L'Hommedieu & Sons Co., Chas. F. 4521 Ogden Ave., Chicago, Ill.	5	Stuts Co., The 430 W. Carroll Ave., Chicago 24, Ill.	
Columbia-Southern Chemical Corp. One Gateway Center, Pittsburgh 22, Pa.		Lindale Equipment & Supply Corp. 504 Smith St., Brooklyn 31, N. Y.	120	Surety Rubber Co. Carrollton, Ohio	
Conforming Matrix Corp. Toledo Factories Bldg., Toledo 2, Ohio	32	Lowe Brothers Co., The Dayton 2, Ohio	12	Syntro Co. Homer City, Pa.	
Cowles Chemical Co. 7014 Euclid Ave., Cleveland 3, Ohio		Macarr, Inc. 2543 Boston Rd., Bronx 67, N. Y.		Technic, Inc. 39 Snow St., Providence, R. I.	43
Crown Rheostat & Supply Co. 1965 Pratt Blvd., Elk Grove Village, Ill.		MacDermid, Inc. Waterbury 20, Conn.	Back Cover	Timesavers, Inc. Box 7446, Robinsdale Station, Minneapolis 22, Minn.	
Davies Supply & Mfg. Co. 4160 Meromac St., St. Louis 16, Mo.		Magnuson Products, Inc. 50 Court St., Brooklyn 1, N. Y.	104	Tranter Mfg., Inc. Lansing 9, Mich.	
Davis-K Products Co. 135 W. 29th St., New York 1, N. Y.	102	Manhattan Rubber Div., Raybestos-Manhattan, Inc. 6 Willett St., Passaic, N. J.		Trerice Co., The H. O. 1424 W. Lafayette Blvd., Detroit 16, Mich.	
Dean Thermo-Panel Coil Div., Dean Products, Inc. 613 Franklin Ave., Brooklyn 38, N. Y.	112	McGoon Chemical Co., The 1040 Midland Bldg., Cleveland 15, Ohio	25	True Brite Chemical Products Co. P. O. Box 31, Oakville, Conn.	110
Deering, Milliken & Co., Inc. 1045 Sixth Ave., New York 18, N. Y.	101	Meeker Company, The 1629 S. 55th Ave., Chicago 50, Ill.		Udville Corp., The Detroit 11, Mich.	13, 83
Detrex Chemical Industries, Inc. Box 501, Detroit 32, Mich.		Metal & Thermit Corp. Rahway, N. J.	11, 31	Unit Process Assemblies, Inc. 61 East 4th St., New York 3, N. Y.	91, 112
DeVilbiss Co., The Toledo 1, Ohio	10	Michigan Chrome & Chemical Co. 8615 Grinnell Ave., Detroit 13, Mich.		U. S. Galvanizing & Plating Equipment Corp. 31 Heyward St., Brooklyn 11, N. Y.	42
Dixon & Rippel, Inc. Box 116, Saugerties, N. Y.	112	Miller Corp., Harry 4th & Bristol St., Philadelphia 40, Pa.		U. S. Stoneware Akron 9, Ohio	86
Dew Chemical Co., The Midland, Mich.		Motor Repair & Mfg. Co., The 1555 Hamilton Ave., Cleveland 14, Ohio	122	Universal Foundry & Machine Co. 14841 Meyers Rd., Detroit 27, Mich.	109
De Pont de Nemours & Co., E. I. — Wilmington 98, Del.	36, 37, 38, 39	Murray-Way Corp. P. O. Box 180, Maple Rd. E., Birmingham, Mich.		Victor Chemical Works 155 No. Wacker Dr., Chicago 6, Ill.	
Egyptian Lacquer Mfg. Co. Box 444, Newark 1, N. J.	94	National Polymer Products, Inc. Reading, Pa.		Worklen, Inc. 253 W. 28th St., New York, N. Y.	
Electro-Glo Co. 1430 So. Talman Ave., Chicago 8, Ill.	32	Nexor Rubber Co., The 2727 Avondale, Toledo 7, Ohio	115	Worthy Products Co. Box 123, Temple, Pa.	122
Electrochemical Products Co. 2800 W. Glendale Ave., Milwaukee 9, Wis.	115	New Holland Machine Co. New Holland, Pa.	111	Wyndotte Chemicals Corp. Wyndotte, Mich.	22
Enthons, Inc. 442 Elm St., New Haven, Conn.	3	N. J. Thermex Co., Inc. 535 Bergen St., Harrison, N. J.	90	Zialite Corp. 92 Grove St., Worcester 5, Mass.	

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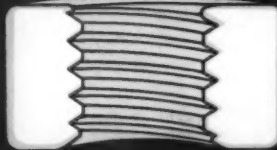
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15

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